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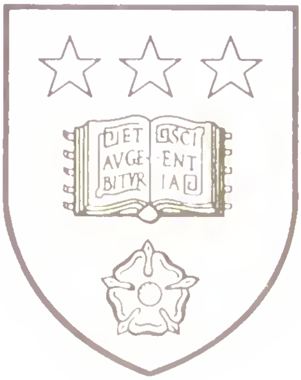

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A TREATISE

ON

DISEASES OF THE EYE, NOSE, THROAT AND EAR.

FOR STUDENTS AND PRACTITIONERS.

BY VARIOUS AUTHORS.

EDITED BY

WILLIAM CAMPBELL POSEY, A.B., M.D.,
PROFESSOR OF OPHTHALMOLOGY IN THE PHILADELPHIA POLYCLINIC; SURGEON TO THE WILLS EYE HOSPITAL; OPHTHALMIC SURGEON TO THE HOWARD AND EPILEPTIC HOSPITALS; MEMBER OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY,

AND

JONATHAN WRIGHT, M.D.,
ATTENDING LARYNGOLOGIST TO KINGS COUNTY HOSPITAL; LARYNGOLOGIST TO THE BROOKLYN EYE AND EAR HOSPITAL; SURGEON TO THE MANHATTAN EYE AND EAR HOSPITAL, THROAT DEPARTMENT; PATHOLOGIST TO THE MANHATTAN EYE AND EAR HOSPITAL.

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NOSE AND THROAT.

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CHAPTER XVI.

THE HISTOLOGICAL PATHOLOGY OF DISEASES OF THE NOSE AND THROAT.

By J. L. GOODALE, M.D.

Preliminary Considerations. A satisfactory classification of diseases of the nose and throat is at the present time difficult to formulate. In the first place the variety of traumatic influences to which these organs are exposed frequently renders doubtful the determination of their etiology, and, second, the insufficiency of the histological data at hand leaves in many directions wide gaps which can be bridged only by reference to analogous processes in other situations. Although any system of grouping that can at the present time be formulated must necessarily experience revision as our knowledge of pathological processes advances, yet, other things being equal, that one is preferable which is most readily susceptible of elaboration and expansion. In the following pages the attempt has been made to bring our comparatively meagre information in regard to the pathological histology of this special field into harmony with the system which has been found most useful in modern general pathology. We shall recognize, therefore, the following main divisions:

1. Disturbances of Circulation.
2. Inflammations.
3. Progressive Disturbances of Nutrition.
4. Regressive Disturbances of Nutrition.

1. DISTURBANCES OF CIRCULATION.

In the upper air passages the conditions comprised under this heading represent a comparatively small group, and one also in regard to which we have but little exact histological data. We may distinguish:

a. Anæmia.
b. Hyperæmia.

The two preceding conditions do not require particular description.

c. Angioneurosis, represented by urticaria and by angioneurotic œdema. Urticaria, although observed upon the mucous membrane of the tongue, does not appear to have been found upon the mucous membranes of the nose or throat. The descriptions by certain authors of "urticaria" of the pharynx and larynx denote evidently angioneurotic œdema, since the lesions involved not only the superficial mucous membrane, but the submucosa as well. We have no histological knowledge of these affections in these situations, but they are probably identical with the corresponding cutaneous alterations.

d. Œdema from cardiac or renal disease. This condition is to be sharply distinguished from acute inflammatory œdema, and from the angioneurotic affection. There is no evidence of active irritation in the tissues. If the stasis is of long duration the vessel walls of the parts become gradually more penetrable, and a large number of white blood corpuscles find an entrance into the neighboring tissues, although at the beginning of the disease there was only a serous transudate without any mingling of the corpuscular elements. This round-celled infiltration finally penetrates the deeper muscular layers and may become gradually assimilated, with the result of producing more or less marked hyperplastic conditions.

e. Hemorrhages. These conditions in the nose and throat are represented by hæmophilia and scurvy. As we have no histological knowledge derived from lesions of the mucous membranes, the reader is referred to the dermatological accounts.

2. INFLAMMATIONS.

Inflammations of the upper air passages may be divided into the following groups: (I.) Neurotic inflammations, (II.) infectious or acute traumatic inflammations, (III.) chronic inflammations with tendency to hypertrophy, and (IV.) chronic inflammations with tendency to atrophy.

I. Neurotic Inflammations.

Under this heading are comprised several forms of inflammation in which the characteristic phenomena appear to be brought about through the nervous system. In all instances it is evident that the primary exciting cause lies beyond the nervous system, which is merely an intermediate agent in the production of secondary manifestations. Our histological information regarding such lesions upon the mucous membranes is extremely meagre. The following groups may be distinguished: herpes zoster, herpes pharyngis, erythema bullosum, and vasomotor rhinitis.

Herpes zoster has been found on the mucous membranes of the mouth, palate, and uvula. It does not appear to affect the tonsils or the pharynx. While the histological appearances do not seem to have been described in these situations, the conditions are undoubtedly similar to those obtaining upon the skin, namely, in the first stage an exudation of clear fluid between the epithelium and the rete mucosa, which in a few days becomes turbid from the advent of leucocytes. At this time a necrosis occurs of the epithelial cells covering the vesicles, causing them to exfoliate, and leaving a denuded rete mucosa.

Herpes Pharyngis. The histological conditions in this affection are probably essentially similar to those of herpes zoster.

Erythema Bullosum. This condition, a form of erythema multiforme, has been described as occurring upon the soft palate, pillars of the fauces, and pharyngeal mucous membrane. Its pathological anatomy in these situations has not been described, but by analogy may be supposed to consist in a sharply circumscribed dilatation of a group of vessels in the submucous tissue, attended by an exudation of fluid through their walls.

Vasomotor Rhinitis. Our histological information in regard to this affection is extremely scanty, much that has been written having apparently been inferred from the macroscopic appearances. A case of the writer's with perennial symptoms permitted the excision of a portion of tissue from the septum, which was examined microscopically. The tissue, which exhibited clinically pallor, swelling, and free watery discharge, showed under the microscope a free desquamation of the epithelial cells, the cytoplasm of which was swollen. The nuclei exhibited a diminished affinity for stains. There was no increase in the number of polynuclear neutrophiles in the intercellular spaces. Thionin showed little or no increase in the number of secreting epithelial mucous cells. The rete mucosa exhibited a moderate œdema, and was traversed by moderately dilated bloodvessels which showed no thickening or swelling of their endothelial cells. The glands were markedly swollen from an increase in the number both of mucous and serous cells. Their lumen showed dilatation, with here and there mucous degeneration of the lining epithelium of the efferent ducts. Below the mucous membrane was a diffuse infiltration of lymphoid cells, plasma cells, and cells showing various degrees of hyaline degeneration. This infiltration was collected particularly around the glands, and did not seem to be more intense than in the case of essentially normal tissues.

The condition differs from that which we should expect to find in acute inflammation, chiefly in what may be called a hydropic alteration of the epithelial cells, in serous transudation, and the relatively slight increase in cellular infiltration. The resemblance, on the other hand, to œdematous hypertrophy is striking. The material at hand is not sufficient to enable us to formulate with certainty universal points of distinction, but attention may be directed to the swollen appearance of the epithelium in the absence of abnormal mucous degeneration. Whether these characters are constant must be determined by further investigations.

II. Infectious or Traumatic Inflammations.

By this term is denoted those inflammations of the tissue directly dependent upon bacterial, chemical, or physical irritants. It should be recognized at the outset that from the histological standpoint the question of the bacterial or non-bacterial nature of the irritant is a secondary one. The effects produced by bacterial toxins may be almost exactly duplicated by chemical, mechanical, or physical agents. We may thus have an acute inflammation of the mucous membrane due to an incision or to a chemical or thermic cauterization, closely resembling that produced by the toxins of the diphtheria bacillus or the streptococcus pyogenes. Another instance may be found in the histological lesions produced by the bacillus of tuberculosis and by an aseptic foreign body. At the present time we are passing from a system of classification founded upon pathological anatomy to one based upon etiology, and although the cause of many affections has been determined, yet for a large class a definite etiology remains to be established. This is particularly true in the case of diseases of the nose and throat, owing to their free and constant exposure to visitations from micro-organisms. While we may, for instance, assume that an acute inflammation of the throat accompanied by the predominance of a certain pathogenic bacterium is due to this micro-organism, yet it must not be forgotten that we are dealing with a territory which may in health harbor normally a number of pathogenic bacteria. As long as the natural powers of resistance of the individual are preserved, the manifestations of pathogenic qualities in these organisms is inhibited. When, however, the vitality of the parts is lowered, directly or indirectly, it is not alone one, but several species of pathogenic bacteria which seize the opportunity for multiplication and for the development of their toxins. On bacteriological examination we thus get a mixed culture, and may be unable to determine the particular rôle played by the different species in the pathological process. While observers have isolated a variety of bacteria from acute local inflammations of the upper air passages (among which may be mentioned streptococcus pyogenes, staphylococcus pyogenes albus, aureus, and citreus; diplococcus lanceolatus, bacillus pneumoniæ, micrococcus tetragenus, and streptothrix buccalis), and although these infections present more or less well-defined clinical points of distinction, we have as yet no corresponding histological evidence of individuality. We must, therefore, be content with a classification based upon their pathological anatomy. The etiological differentiation of these conditions forms a most promising field for future study.

While both a primary trauma (*i. e.*, an agent which suspends the normal function) and secondary irritation from the introduced substance (*i. e.*, toxin or other foreign body) are essential to the production of the histological lesions, yet great variation may exist in the relative preponderance of these two factors. For instance, an acute pharyngitis may occur as the result of a chilling of the body, followed by bacterial invasion of the tissues, or as the result of a chemical, thermic, or physical wounding of the parts, with secondary development of bacteria upon the injured surfaces. In the first instance the character of the lesions is influenced chiefly by the bacterial infection, in the second case by the nature of the primary trauma.

On the basis of the preceding considerations, infectious inflammations may be divided into, first, (A) inflammations of undetermined bacteriology; second, (B) inflammations due to a specific microorganism. The former class will be first considered.

A. **Infectious Traumatic Inflammations of Doubtful Bacteriology.** These comprise the larger number of acute affections of the nose and throat. Their phenomena may be manifested by a degeneration and necrosis of cells, by exudation from the bloodvessels, by proliferation of the cells, and by phagocytosis. Histologically we may divide them into, first, acute proliferative or catarrhal inflammations of the mucosæ and lymphoid tissue; second, exudative or fibrinous inflammations; third, suppurative inflammations, either with abscess formation or with diffuse phlegmonous inflammation. The occurrence of these different conditions is dependent both upon the severity and the anatomical localization of the infection or trauma. The streptococcus pyogenes, for instance, may produce a proliferative tonsillitis or an exudative tonsillitis, or an intratonsillar abscess. It will therefore be most convenient to study these conditions from the anatomical standpoint, and we shall therefore distinguish, first, (*a*) inflammations of the mucous membrane and lymphoid tissues; second, (*b*) inflammations of the submucous tissues and deeper structures.

a. **Inflammations of the Mucous Membrane and Lymphoid Tissue.** Acute inflammations of the mucosæ may be proliferative or exudative, according as the irritating agent is mild or severe. In the first case the result is an acute catarrhal rhinitis, pharyngitis, or laryngitis, and in the latter it is a fibrinous inflammation of these parts.

The proliferative or catarrhal inflammations of the mucosæ are almost unknown to us histologically, owing to their tendency to recovery. A case of acute rhinitis studied by Suchannek exhibited a swelling and œdematous infiltration of the mucous membrane, associated with dilatation of the bloodvessels, increased mucous secretion, marked round-celled infiltration, particularly in the subepithelial layer, escape of red blood corpuscles from the vessels, and desquamation of the epithelial cells. The mucous glands showed a marked degeneration and exfoliation of the epithelium. In all probability these alterations exist in acute pharyngitis and laryngitis, their individual modifications depending upon the anatomical structure of the part.

Where the irritant is of peculiar intensity the preliminary phenomena of proliferation of the tissue cells are followed by fibrinous exudation from the bloodvessels. It should be emphasized that this condition is not separated from the preceding one of proliferation by definite etiological boundaries, but represents merely the effect of a stronger toxin upon the affected tissues. In the majority of cases this affection is diphtheritic, but in a certain number of cases the diphtheria bacillus was not found. Our only histological account of non-diphtheritic fibrinous rhinitis is derived from a case of Seifert's, who says:

"On the external margins of the section the epithelium is intact, but penetrated by round cells. Investigation of the neighboring places shows an increase of the round-celled infiltration in the submucosa and epithelium, with the appearance of a thin layer of fibrin on the epithelium. In other places the layer of fibrin increases in thickness and is penetrated by numerous round cells, but the epithelium and submucosa show no other alterations beside those already mentioned. Even where the fibrin layer is thickest there is no necrosis of the epithelium. The condition is therefore exclusively an exudation on the mucous membrane."

Proliferative and exudative inflammations of the lymphoid tissue are relatively well known to us histologically from recent studies of the faucial tonsils. As the structure of the various parts of the tonsillar ring is practically identical, we shall confine ourselves to a somewhat detailed description of the phenomena as they appear in the faucial tonsils.

In diffuse proliferative tonsillitis the follicles exhibit enlargement, due to an increased number of their lymphoid cells, particularly on the side adjacent to the nearest crypt, and of the endothelial cells of the reticulum. The proliferation of these endothelial cells gives rise to large phagocytic epithelioid cells, characterized by a relatively large amount of markedly acidophilic cytoplasm, and an irregular, lightly staining, eccentrically situated nucleus. They contain in their interior from one to ten or fifteen cells or cell fragments, which are generally lymphoid cells and red blood corpuscles in various stages of digestion. The incorporated cells do not appear to lie directly in contact with the cytoplasm of the phagocytic cell, but are generally situated in clear spaces or vacuoles. The lymphoid cells between the follicles are increased in number and closely packed together. The endothelial cells of the reticulum of the interfollicular regions show an increased proliferation, with formation of epithelioid cells. Toward the mucous membrane the lymphoid cells exhibit a transition into plasma cells, and are associated with polynuclear neutrophiles. The bloodvessels are dilated, filled with red and white blood corpuscles, and show more or less marked proliferation and exfoliation of their endothelial cells. The cells of the mucous membrane show a connective-tissue proliferation and exfoliation. The epithelium of the crypts is loosened from a widening of the intercellular spaces, which are crowded with escaping lymphoid and plasma cells. Bacteria, chiefly cocci, occur superficially in the epithelium

PLATE XX.

Fig. 1.

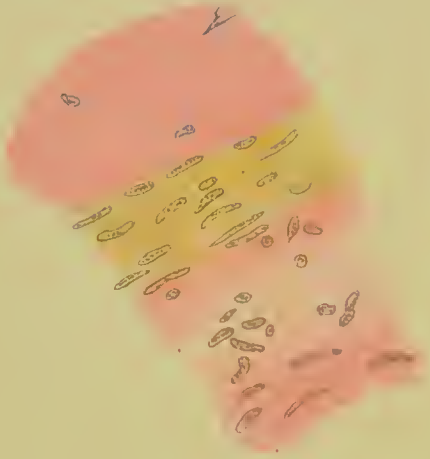


Fig. 2.

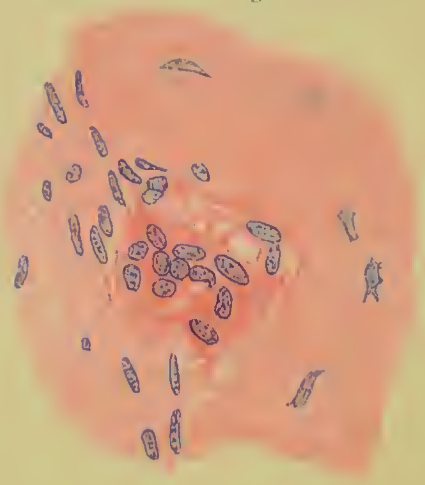


Fig. 3.

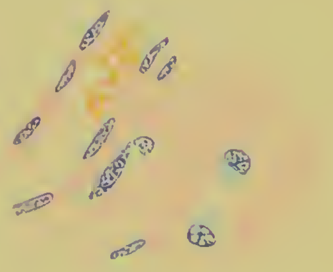


Fig. 4.

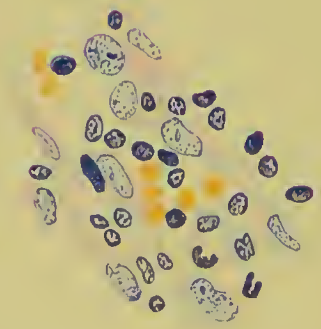


FIG. 1. Hyperplastic periostitis of the middle turbinate, Van Gieson stain. The periosteum is seen to be markedly proliferating and forming a broad osteoblastic zone.

FIG. 2. Rarefying ostitis, hæmatoxylin-eosin stain. A large osteoclast with many nuclei is seen in the centre of the field, producing erosion and absorption of the surrounding bone.

FIG. 3. Plasma cells from nasal polypi stained with polychrome, methylene blue, and eosin. Two plasma cells, the protoplasm of which takes the methylene blue stain, are seen a short distance from the bloodvessel.

FIG. 4. Swelling and proliferation of the endothelium of a bloodvessel in acute tonsillitis. The endothelial cells show a swelling of their nuclei and protoplasm, together with a loosening from the wall of the vessel.

PLATE XXI.

Fig. 1.

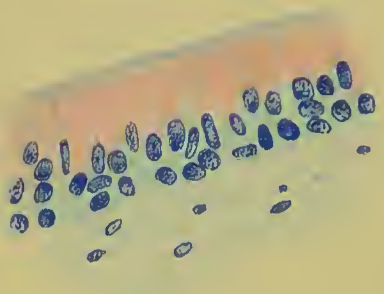


Fig. 2.

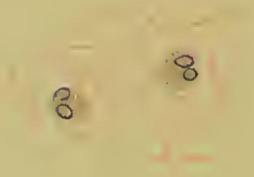


Fig. 3.

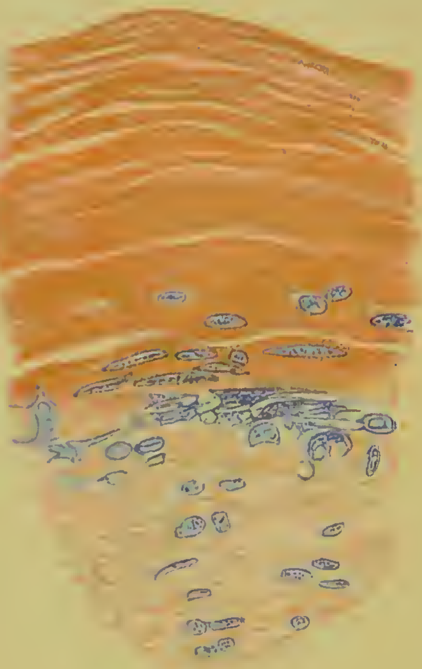


Fig. 4.

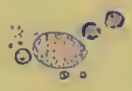


Fig. 5.

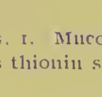


FIG. 1. Mucous degeneration of the epithelium in chronic hypertrophic rhinitis, Hoyer's thionin stain. The protoplasm of the affected cells takes a characteristic pink stain.

FIG. 2. Hyaline degeneration of plasma cells (early stage), stained with carbol fuchsin and iodine green. The cells are filled with minute granules of varying size, which show the characteristic affinity for fuchsin.

FIG. 3. Horny degeneration of epithelium, stained with methylene blue and neutral orcein. Portion of a wall of a crypt from a case of tonsillar keratosis. Numerous layers of horny epithelium show the orcein stain with various shades of color.

FIG. 4. Phagocytic epithelioid cell from the reticulum of tonsil. Polychrome methylene blue and eosin. The cell, which is fixed in a shape suggestive of amœboid motion, is seen to have incorporated three lymphoid cells, together with several small fragments of nuclear detritus.

FIG. 5. An epithelioid phagocyte undergoing mitosis, showing numerous incorporated cells and cell fragments.

lining the crypts, but apparently are absent in the lymphoid tissue. The crypts are filled with exfoliated epithelial cells, leucocytes, bacteria, amorphous débris, and in severe cases fibrin, which encloses cells and bacteria in a delicate network. At times the fibrin may extend from the crypts into and even beyond the epithelium, penetrating most deeply in the interfollicular regions. Bacteria are most abundant near the surface of the crypt, gradually diminishing in numbers toward the base. The phagocytic polynuclear neutrophiles contain bacteria in their interior, and may exhibit a network fragmentation with dispersion of their chromatin. (Plate XX., Fig. 4, and Plate XXI., Figs. 4 and 5.)

The acute lacunar ulcerative tonsillitis of Moure and others is known to us chiefly through clinical descriptions. As far as the writer can ascertain from the histological accounts, it is possibly identical with the condition described below under suppurative tonsillitis, where an intrafollicular abscess is discharging into a crypt.

b. **Submucous Inflammations.** Under this heading are comprised those diseases in which the submucous tissue forms the chief seat of the inflammatory processes. On pathological grounds we may distinguish, first, a stage of œdema; second, a plastic stage; third, a suppurative stage. The distribution of these processes is largely dependent upon the structure of the tissues involved. Since the inflammatory processes extend in the direction of the least resistance, those tissues with a loose or distensible submucosa experience greater alterations than those of a more compact nature.

A submucous œdematous inflammation of the nose was found by the writer in one instance localized on the septum posteriorly, and was seen histologically to consist in a forcible stretching of the enveloping mucous membrane and the underlying connective-tissue spaces by the escape of the serous fluid into a circumscribed area. The mucous membrane consisted of from three to six layers of columnar epithelial cells without evidence of cilia. Here and there the mucous membrane was absent or represented by tattered and loosely hanging columns of cells, while in several places vertical cracks and fissures through the mucous membrane were apparent. The individual epithelial cells seemed essentially normal. In the intercellular spaces were seen numerous polynuclear neutrophilic leucocytes, lymphoid and plasma cells. The body of the mass below the mucous membrane was composed of a delicate network of connective-tissue fibres with wide interspaces. In many places the fibres seemed forcibly ruptured from their connections, leaving ragged and frayed ends separated by a varying distance. Scattered about in this area were a number of mucous glands of essentially normal size and appearance, surrounded by a moderate number of lymphoid cells with a few plasma cells and Mastzellen in a manner similar to that which occurs in the ordinary hypertrophied mucous membrane. There were numerous thin-walled channels lined with endothelium containing red blood corpuscles and a few polynuclear neutrophiles and lymphocytes.

The œdematous inflammation of the uvula and larnyx are probably essentially identical histologically with the above.

The suppurations below the mucous membrane may be focal or diffuse.

The focal suppurations are found in the nose as abscess of the septum, and in the throat as abscess of the tonsil, pharynx, or larynx.

Abscess of the nasal septum occurs as acute idiopathic perichondritis of the septal cartilage and as traumatic abscess. In the first instance we have to do with a more or less extensive suppurative softening of the tissues without evidence of trauma, or contagion, or constitutional disease. The inflammation affects the whole mucous membrane in all its layers, the cartilage, and even the bone in the vicinity. While we know that infectious organisms are the cause of the condition, the method of their penetration into the tissues has not been determined. The traumatic abscess differs from the preceding condition merely in the fact that a submucous or subperiosteal hæmatoma has been formed as a result of trauma, with secondary infection and suppuration. The histological details of the two conditions have not been described, but may be inferred from our knowledge of analogous processes.

Serous Perichondritis of the Septum. In this affection the clinical manifestations of bilateral occlusion of the nasal openings by two pale red tumors yielding on incision a serous fluid, and terminating by a certain amount of sinking in of the bridge of the nose, have been supposed by some observers to consist histologically in a primary affection of the triangular cartilage, due to a degeneration of the cartilage, with softening and formation of cavities filled with homogeneous cheesy masses, and associated with serous exudation, proliferation, and new formation of bloodvessels. By others it is believed to be similar to perichondritis serosa, which frequently occurs at the diaphysis of the long bones in young individuals.

In certain cases of tonsillitis abscess formation occurs. The abscesses are situated at the beginning in the interior of the follicles, enlarge later, and eventually discharge into the crypts. The relative frequency of these abscesses varies greatly in different cases, but is apparently associated with a more severe clinical type of the disease, and has been found particularly in association with the streptococcus pyogenes. The presence of the abscess in its early stage is indicated by a circumscribed infiltration of polynuclear neutrophiles among the endothelial cells of the reticulum occupying the centre of the follicle. The bloodvessels in the immediate neighborhood contain large numbers of polynuclear neutrophiles, of which many are seen in the act of passing through the vessel wall. The endothelial cells of the vessel show a varying amount of swelling. Micrococci are found in varying numbers in the region occupied by the polynuclear neutrophiles, lying for the most part free in the intercellular spaces, although they not infrequently may be seen in the interior both of the polynuclear neutrophiles and of the large endothelial phagocytes previously described. With the growth of the abscess the follicle increases very considerably in size, as the result largely of a heightened proliferation of the endothelial cells of the reticulum. Those in the immediate vicinity of the abscess show a swelling of their cytoplasm and an irregularity in outline of their nucleus, which appears elongated, indented, or twisted. A marked increase is simultaneously observed in the number of large phagocytes in the vicinity, which contain also a greater number of incorporated cells and fragments. The growth of the abscess is usually in the direction of the nearest crypt. The polynuclear neutrophiles of the abscess first penetrate in a more or less compact wedge the dense collection of lymphoid cells which encircles the central reticulum, and advancing toward the mucous membrane of the crypt, infiltrate this and cause it to become exfoliated over a definite area. The abscess now discharges freely into the crypt, which becomes filled with polynuclear neutrophiles, cellular detritus, and bacteria. Lymphoid and plasma cells are relatively less abundant than in cases without abscess formation. Fibrin in the crypts appears, on the other hand, more abundant. The relative size of the abscesses varies greatly in the different follicles in the same tonsil, some being barely recognizable, while others are already discharging into the crypts. Occasionally two or even three abscesses are found in a single follicle and these are generally of different sizes.

In some instances circumtonsillar inflammation is observed in association with or subsequent to intratonsillar abscess. In these cases the connective-tissue spaces of the reticulum adjoining the tonsillar abscess are crowded with polynuclear neutrophiles, which may extend in direct continuity toward the base of the organ in the direction of the circumtonsillar abscess. It is reasonable to suppose that the circumtonsillar inflammation is the result of the discharge of the intratonsillar abscess into the efferent lymph channels.

Circumscribed abscesses of the pharynx are probably essentially similar to those of the circumtonsillar region, and need not be discussed in further detail. In the larynx they occur particularly in the epiglottis, the aryepiglottic folds, the vocal cords, and the interarytenoid region. The histological picture here is exceedingly variable, and dependent both upon the localization of the process and the original cause of the inflammation.

Diffuse suppurative inflammations or phlegmonous inflammations occur particularly below the mucous membranes of the nose and throat as the result of an invasion of pyogenic micrococci. The conditions are analogous to those of deep erysipelatous inflammations of the skin.

B. **Infectious Inflammations due to a Specific Micro-organism.**

Diphtheria. Diphtheria manifests itself in the mucous membranes of the nose and throat in the form of an inflammation, which may be catarrhal, exudative, or necrotic. There is no reason to suppose that the first condition differs histologically from that occurring in acute rhinitis. The formation of the pseudomembrane begins usually with necrosis of the epithelium and with the deposition of an exudate in and upon the surface of the latter. This pseudomembrane may be deposited in one or in several layers, which may show certain differences of age among themselves. It consists either of a delicate fibrin network or of a closely woven network of thick glistening strands, in the meshes of which there may be either many leucocytes or almost no cellular elements. The upper layers of the pseudomembrane, which as a rule contain the largest number of bacteria, are frequently seen to have undergone fragmentation into a granular detritus. The degenerated epithelium disappears usually through exfoliation, although at times remnants of the epithelium may be found. The mucous membrane itself experiences alterations in the form of hyperæmia, round-celled infiltration, and frequently fibrinous exudate. If the necrosis is limited to the epithelium recovery occurs without scar formation. If the mucous membrane is invaded, however, by the necrosis, a loss of substance occurs and heals by granulation and the formation of cicatricial tissue. The bacillus of diphtheria is constantly found in the pseudomembrane, most frequently in the superficial layers, but also in the superficial layers of the mucous membrane.

In the tonsils a diffuse necrosis of the epithelium may occur, affecting the single cells, or there may be a necrosis and ulceration extending into the lymphoid tissue from the crypts. There may be a formation of membrane secondary to the ulceration, and fibrinous membrane formed directly in the lymphoid tissue. In these cases the reticulum is apparently converted into hyaline fibrin. In some cases there may be an extensive hemorrhage accompanied by fibrin and necrosis, although fibrinous exudation without hemorrhage frequently occurs. Micro-organisms are rarely found in the tissue on microscopic examination.

Influenza. Microscopic examination of the nasal mucous membrane in cases characterized clinically by simple hyperæmia shows but slight alterations, these consisting chiefly in a dilatation of the bloodvessels and increased emigration of leucocytes through the epithelium. In cases of greater severity there appeared an increased amount of infiltration in the adenoid layer, together with heightened desquamation of the superficial epithelium, exudation of blood into the tunica propria and through the epithelium, with mucous degeneration of the superficial epithelium. The œdema has been observed to be rather irregularly distributed, being in some places entirely absent, and in others concealed by a proliferation in the lymphoid layer. A characteristic feature is the desquamation of the glandular epithelium, which may be exfoliated over a continuous area, and in this condition filling the lumen of the glands. The process appears to be extremely rapid. The pharynx shows an infiltration of the mucous membrane with leucocytes, together with dilatation of the capillaries and small veins. In the larynx and trachea hyperæmia of the mucous membrane exists to a greater or less extent, unevenly distributed, and at times so intense that the papillæ appear to consist solely of dilated bloodvessels. This dilatation affects the small veins and the veins of the capillaries, while the arteries themselves are generally empty and contracted. The mucous membrane is simultaneously infiltrated with leucocytes, which here and there give rise to the formation of small lymphoid swellings. In the more marked degrees of hyperæmia there is stasis of the blood in the vessels which are distended with leucocytes. These latter form small heaps within the lumen of the vessels, frequently associated with thrombi and micro-organisms. The vessel walls show proliferation of the lining endothelium. The limiting membrane of the mucous membrane appears thickened and hyaline. The mucous membrane may become translucent and show mucous degeneration, with at times superficial areas of necrosis appearing as small ulcerations, the floor of which may be formed by the bare cartilage. In some cases this necrosis is due to thrombosis in the vessels, in others it is probably due to stasis and infiltration of blood. The distribution of the influenza bacillus in the mucous membranes of the nose and throat is not known.

Typhoid Fever. The manifestations in the upper air passages accompanying typhoid fever may be divided into three groups:

1. An active hyperæmia, loosening and desquamation of the epithelium, producing erosions which then form the entrance point for micro-organisms which, mingled with the exfoliated epithelium, produce a whitish deposit upon the mucous membrane. The micrococci find a favorable soil in the affected tissue, penetrate into the vicinity, and fill the dilated lymph vessels with thrombi.

2. Ulcerations occur as a later stage of the preceding manifestations. These may lead to perichondritis in the larynx and necrosis of the cartilage, particularly the epiglottis and the arytenoids.

3. Typhoid ulceration which behaves in the same manner as the characteristic intestinal affection. These affect the adenoid substance in the larynx by preference, and also the anterior commissure and the base of the arytenoids. The primary swelling in these areas is due to a penetration of typhoid bacilli into the lymph sinuses with a production of toxin. The direct action of the toxin upon the tissue causes an inflammatory exudation of serum and leucocytes into the outer portion of the lymphoid areas and the adjoining tissue. Later the exudation disappears and is followed by an intense desquamation of the endothelial cells lining the reticulum of the lymph spaces. These cells are occasionally phagocytic. Finally, necrosis and sloughing of the newly formed tissue occur, and repair by granulation tissue follows from the base of the ulcer.

Tuberculosis. The histological unit in this affection is the miliary tubercle, a clump of epithelioid cells produced by proliferation from the endothelial and connective-tissue cells, with or without the association of giant cells. It may appear upon the upper air passages in an acute or chronic form, in the first instance as a part of a more or less generally distributed acute miliary tuberculosis. These tubercles are distributed in the subepithelial layers of the mucous membrane, and are practically identical histologically in every situation. As a rule, a fatal termination of the case prevents their developing into the stage of caseation or ulceration.

The chronic forms of tuberculosis in the upper respiratory passages occur as an ulceration or as a tumor, or as a combination of both. These phenomena vary somewhat according to the site of the process.

In the *nose* the tubercular ulceration presents itself in the form of an infiltration in the subepithelial region of connective-tissue cells and endothelial cells aggregated more or less closely, and containing here and there giant cells and a few tubercle bacilli extending in the direction of the epithelial surface. Central caseation and necrosis of these tubercles ensue, with the result of causing an exfoliation of the overlying mucous membrane, thrombosis in the terminal bloodvessels, and the production of a granular detritus upon the floor of the ulcer.

The tubercular tumor, or tuberculoma, of the nose is extremely variable histologically, but consists essentially of an aggregation of connective tissue and endothelial cells which proliferate to form epithelioid cells. The new-formed tissue is traversed by young bloodvessels and contains scattered through it giant cells and tubercle bacilli in varying numbers. The whole is covered frequently by more or less normal epithelium. Glands may or may not occur. Toward the peripheral portion of the tumor obliterative endarteritis at times occurs, leading to thrombosis and peripheral necrosis of the tissue. Structures have been found in these growths in the neighborhood of the giant cells and in their interior, composed of concentrically arranged, degenerated, elastic fibres, infiltrated with mineral salts, which are supposed to arise from the hyaline degeneration of the bloodvessels.

Tuberculosis of the tonsil appears in three forms:

1. Irregular shallow lesions occur in which the epithelium of the crypts is destroyed without the previous formation of tubercles. Ulcerations of this sort are superficial and affect the whole of the crypt, or at least most of its wall. In the centre of such ulcerations we find no products of caseous metamorphosis, neither epithelium nor giant cells. The floor of the ulcer consists exclusively of infiltrated lymphoid tissue in which the bacilli are found in great numbers. The contents of the crypts consist of yellowish-white matter of thick consistence, without odor, and containing numerous tubercle bacilli. Later the tubercular process extends into the deeper lymphoid tissue, giving rise frequently to cervical adenitis.

2. The common form, with typical tubercles, giant cells, and caseous degeneration in its early stages is characterized by the appearance of tubercles under the epithelium and around the crypts in the form of small light points. The first of such tubercles generally occur in the lymphatic sinuses. When the process is more advanced and some

tubercles have undergone caseous metamorphosis there is an invasion of the connective tissue. Around the epithelioid cells there is a region of intense round-celled infiltration. In the follicles it is not possible always to separate this layer, since it sometimes coalesces with the infiltration of the neighboring tubercle, and is somewhat obscured by the similar appearance of the follicles themselves. The bloodvessels are numerous and show a marked thickening of their adventitia, particularly in the neighborhood of the tubercles. Caseous metamorphosis begins generally in the centre of the tubercle in a giant cell, or at times in epithelioid cells. Further development of this leads finally to ulcerations which attack the walls of the crypts. Such ulcerations are deeper, their floor is covered with caseous detritus, and consists of epithelioid cells, among which are varying numbers of giant cells.

3. A diffuse tubercular infiltration occurs in which the tonsil loses almost completely its normal structure, and is reduced to a mass of endothelial, epithelioid, and giant cells in a fibrous reticulum covered by mucous membrane. This represents the tubercular tumor above mentioned.

Tuberculosis of the adenoid may occur in a latent form without macroscopic alterations, showing histologically tubercles singly and in groups on either side of the crypts in the lymphoid tissue, consisting of large epithelioid cells containing in their centre one or more large giant cells. In young individuals the cylindrical epithelium predominates, but in older persons the pavement type usually replaces it on the surface, although it is often well preserved in the deeper portion of the crypts. The extension of the tubercular foci varies in different cases, being at times isolated and at times confluent. Giant cells are numerous, but bacilli are few. This latent tuberculosis may be the first and exclusive point of localization, although it is more frequently associated with an infection elsewhere in the body.

The follicles at the *base of the tongue* are at times affected by tubercular ulcerations which extend from the floor of the crypt to the point of entrance, and develop over a greater or less extent of the lingual mucous membrane.

Tuberculosis of the larynx occurs as a more or less diffuse infiltration and ulceration, or as a circumscribed tubercular tumor. In the first instance we have to do with an infiltration into the subepithelial layers of the mucous membrane of tubercles, which may undergo early caseation and produce ulcerations of the overlying mucous membrane, or may remain for a longer period in a formative state. The first outcome is particularly prone to occur in those situations most subject to motion and friction, such as the interarytenoid region, the margin of the vocal cords, and the epiglottis. When an ulceration has once formed its margins frequently undergo proliferation, which may attain a considerable size. The infiltrations of longer standing are seen more particularly in the neighborhood of the arytenoids and the ventricular bands. In the arytenoid region lesions of *perineuritis*, particularly perineuritis of the recurrent nerve, have been found in the centre of the infiltrated tissue. The essential nature of the alterations consists of a compression of the affected nerves by granulation tissue. In addition to the thickening of the neurolemma, there is an invasion of the tissue by proliferating connective-tissue cells. The myeline undergoes fragmentation, and later disappears. Finally, the axis-cylinder is completely destroyed. This proliferation is accentuated in the region of the glands, where nervous filaments are seen to give off nerve terminals running between the acini. In and around the tubercular granulations the nerve alterations appear in the form of genuine nervous tubercles formed by concentric filaments, without any apparent lesion either of the myeline or of the axis-cylinder. These lesions are essentially proliferative and hyperplastic, and by their anatomical character and development approach neuromata.

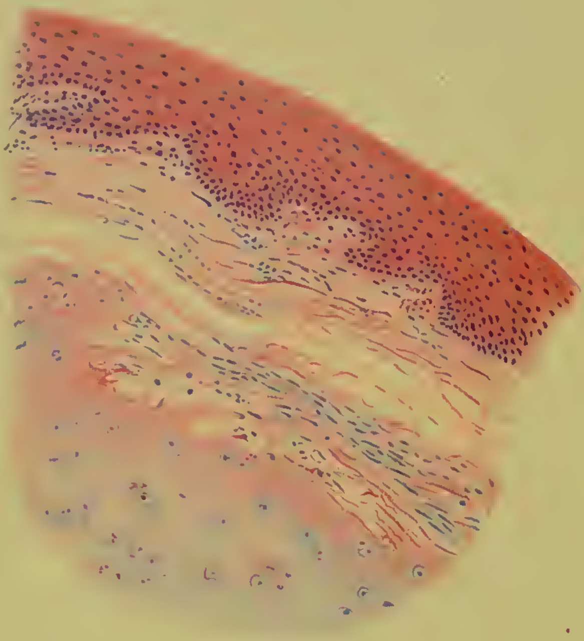
The tubercular tumor consists histologically of a diffuse tubercular infiltration in the form of granulation tissue covered with stratified pavement epithelium. The granulation tissue consists partially of round cells with darkly staining nuclei, partly of epithelioid cells, with a varying number of giant cells, the latter exhibiting usually caseation. This granulation tissue is divided into different areas by connective-tissue trabeculæ proceeding from the submucous connective-tissue capsule.

The final stage of the tubercular lesion is a sclerosis, more or less generalized, consisting histologically in a thickening of the interstitial fibrous tissue, principally around the vessels and below the epithelium. If ulcerations have occurred previously the epithelium is wanting, and the surface is formed by scar tissue. In the lymphoid tissues the follicles are frequently atrophied and degenerated.

Lupus. The histological conditions occurring upon the mucous membranes in this affection are essentially like those in true tuberculosis. The unit is the lupus nodule, which invades the mucous membrane irregularly and at different depths, and is sharply distinguished from the surrounding tissue. The nodule is composed of granulation tissue consisting of fibrous trabeculæ of varying size penetrated by numerous bloodvessels, large, strongly refractile, deeply staining, nucleated cells, together with smaller cells and epithelioid and plasma cells. In the later stage the blood and lymph vessels exhibit a proliferation of their adventitia in association with proliferation of the connective-tissue cells.

This stage is followed by retrograde metamorphosis, which is manifested first by a diminution in the vascularity of the centre of the nodule. The cells become inflated, granular, and fragmented. In many places there appear giant cells resembling those of tuberculosis and syphilis. A portion of the lupus tissue exhibits an organization into young connective tissue which later cicatrizes. While this process is going on in some nodules, others arise in the vicinity and extend as far as the submucosa, with the result of producing an irregu-

PLATE XXII.



Proliferative Perichondritis. Section through a Spur of the Septal Cartilage, showing Chondroblasts and Newly-formed Cartilage. Hæmatoxylin-eosin.

lar diffuse infiltration of all the layers of the mucous membrane. This may undergo cicatrization or lead to a connective-tissue hypertrophy, with the result of producing enlarged papillæ with correspondingly large interpapillary prolongations. The epithelium may exhibit proliferation, vacuolization, and may be thrown off by a process of suppuration and desquamation. This may eventually heal by fibrous contraction and cicatrization, leaving a thin superficial scar.

Syphilis. The histological unit of syphilis appears in the mucous membranes as a sharply circumscribed and compact infiltration in the papillæ and mucosa of round cells, which do not pass into permanent organs of connective tissue, but always undergo retrograde metamorphosis, either by absorption or suppuration. This infiltration has a characteristic direction and method of progress, according to which the infiltration on one side constantly enlarges, and on the other side exhibits retrograde metamorphosis. The enlargement and the retrogression take place always in a centrifugal manner.

The initial lesion may occur in three forms upon the tonsil, namely, the erosive, the ulcerative, and the anginous. Our histological information regarding these varieties is meagre.

Secondary lesions in the tonsils and neighboring mucous membranes are seen histologically to consist of an infiltration of endothelial and plasma cells which are situated in large groups together, interspersed between the loosened epithelial cells. Many of the latter exhibit a nuclear fragmentation. The papillæ are enlarged, the bloodvessels are dilated, the former being infiltrated, and the latter enveloped with a thick mantle of round cells.

The palatal muscles may show an involvement, consisting of an infiltration of the bloodvessels of the perimysium corresponding to their arrangement around the primary muscle bundles, up to their branching and final termination in the capillaries. There is also a proliferation of the perimysium itself. In association with these lesions giant cells may occur in the sarcolemma, and the transverse striations of the muscles may disappear.

Tertiary lesions are supposed to arise from unabsorbed exudates left behind from the secondary stage. We may distinguish the gumma and the granuloma, the latter having been reported only from the tissues of the nose. The gumma consists in all situations of the same histological elements, namely, a more or less compact aggregation of proliferating endothelial and connective-tissue cells, epithelioid cells, and giant cells. The bloodvessels in the vicinity show a thickening of their adventitia. Retrograde metamorphosis takes place by caseation, beginning in the giant cells and epithelioid cells, extending peripherally, and leading to exfoliation of the overlying mucous membrane.

The granuloma, which appears clinically in the nose as a broad or pedunculated tumor of varying size, situated upon the mucous membrane, of a friable consistence, but without tendency to central softening, is seen histologically to consist of an endothelial and connective-tissue proliferation, with giant cells and thickening of the vessel walls, in the younger stage closely resembling gummata. Later, through a swelling of the deeply-situated tumor, the mucous membrane is forced out above the original level, often becoming pedunculated. Retrograde metamorphosis occurs in the older portions of the growth, namely, at its periphery, in the form of obliterative endarteritis with thrombosis and necrosis.

A form of syphilitic lesion occurs at the base of the tongue as an atrophy of the lingual follicles. This is due either to an interstitial inflammation, leading to a diminution in the number and diameter of the lingual follicles, or to scar formation following tertiary lesions of the mucous membrane.

Leprosy. In leprosy of the upper air passages four stages may be distinguished: the prodromal, infiltrating, ulcerating, and the cicatrizing. The prodromal stage may be extremely prolonged. After marked infection and swelling of the mucous membrane the disease attacks particularly the septal cartilage, being frequently superimposed upon a rhinitis sicca anterior. For this reason nasal hemorrhage has been frequently given as a prodromal symptom of leprosy.

The stage of infiltration consists of a firm swelling and reddening of the mucous membrane of the septum as well as of the turbinates, associated with a hypersecretion, at first serous, later purulent. The infiltrations may remain diffuse or pass to the formation of individual nodules ranging from the size of a pinhead to that of a pea. This infiltration shows a tendency to rapid necrosis, most frequently in the anterior portion of the cartilaginous septum, and attacking at times the bone secondarily, either by caries, or at times by osteoporosis. There is an enormous crust formation, extremely hard, and associated with fetor.

The stage of cicatrization follows the completion of the ulcerative process, and leads to the extensive cutization of the mucous membrane, the surface of which now resembles dry leather, is anæmic, and whitish yellow or brownish red. The turbinates are greatly reduced and sometimes absent. Synechia or atresia frequently exist associated with local anæsthesia. At times extensive superficial ulcerations occur as the result of trophoneurotic disturbances in the region of the trigeminal nerve, which begin with the outbreak of follicles resembling those of herpes and pemphigus.

Mycosis Fungoides. Histologically this process consists of an infiltration of typical round cells proceeding from the vessels in the chorion and subcutaneous tissue. This infiltration is deposited in a fine network of delicate fibrillary connective tissue. The epithelium appears at first proliferating, growing into papillæ, later flattened over the nodules. The round-celled infiltration appears aggregated between the connective-tissue spaces in the form of foci of varying size, like a nodule, which, however, toward its periphery assumes again the character of an infiltration.

These growths, resembling somewhat lymphoid structures in appearance, although no follicles are recognizable, occur upon the mucous membranes of the throat, and may become superficially ulcerated.

Leptothrix Mycosis. The leptothrix buccalis, which occurs normally in the mouth as a saprophyte, assumes at times pathogenic properties. The mucous membranes of the lymphoid tissue of the fauces and of the larynx and œsophagus when greatly depreciated in vitality as the result of previous prostrating disease, may become susceptible to the development of the leptothrix buccalis, the threads of which may penetrate between the upper epithelial layers and into the orifice of the glands. The invasion of the tissues by the mycelium may be followed by a secondary involvement of other pathogenic organisms, such as the pyogenic cocci and the diphtheria bacillus.

Structures occur at times in the tonsils having a certain resemblance to actinomyces. The structure is of botryoid shape, with a diameter of 0.5 mm., appearing when stained with alum carmine and then by Gram as a dark blue more or less compact network of threads lying in a fine granular substratum, which partakes of the carmine stain with irregular intensity. Toward the periphery of the structure the threads radiate outward and exhibit nodular thickenings, due to irregular clumps of threads and cocci. Toward the centre the threads cross each other, are much shorter, and resemble sharply-bent rods. Tree-like branchings of the threads are common, particularly toward the periphery.

Ruge regards these structures as belonging to the group of actinomyces, which are, however, not identical with human actinomyces. They belong probably to the group of leptothrix buccalis and are probably closely related to a form of streptothrix described by Sbarazes.

It is possible that the mycosis of the tonsil and pharynx may be produced by the growth just described.

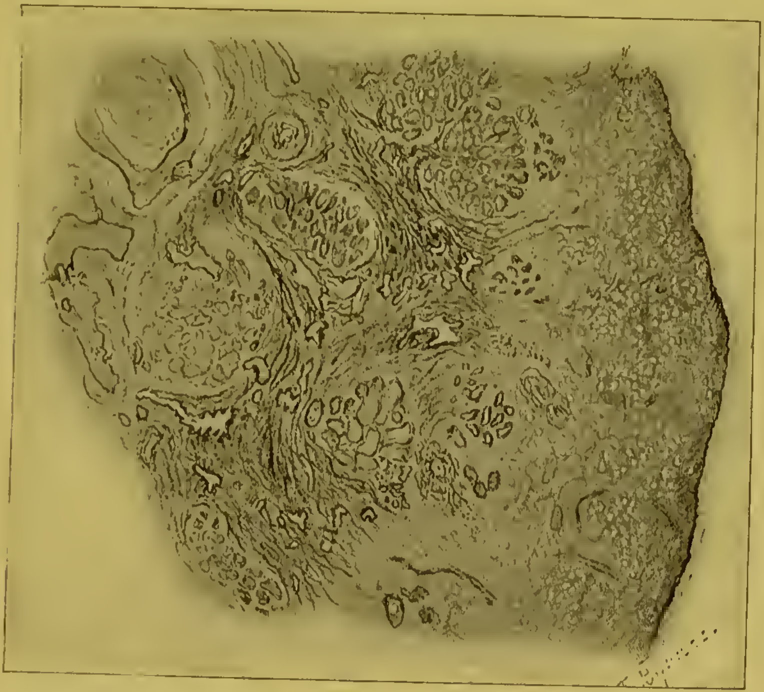
Rhinoscleroma. In the nose and larynx the affected tissues are seen histologically to consist of certain typical elementary lesions. The substance of the swelling is composed of large plasma cells, irregularly distributed in all layers of the mucous membrane and in the submucous tissue. They accompany the bloodvessels in the new portions of the growth. The plasma cells do not contribute directly to the hypertrophy, but it is possible that they become changed partly into spindle cells, and then give rise to the formation of new fibrillary tissue. Two forms of retrograde metamorphosis occur in the plasma cells. These may be transformed into swollen, hydropic, so-called Mikulicz cells, or into hyaline degenerated cells probably identical with the so-called Russel's fuchsinophiles, described under colloid degeneration. The hydropic cells lie close together, have a distinct contour and spongy cytoplasm dilated into large masses in which there is a but slightly refractile, faintly staining, half-fluid mass within a small faceted nucleus. In the vicinity of these typical degenerated cells transition cells occur which are seen to be derived from degenerated plasma cells. In this stage one often sees from six to eight bacilli in the cells near the nucleus, which lie always at regular distances. This stage appears, however, to be rapidly finished, and when the cell membrane breaks the fluid contents, together with some of the bacilli, find an exit and fill the nearest lymph spaces. These cells, are however, intimately related to the direct action of the bacilli. In all instances the peculiar capsule bacillus is present. The cells which show hyaline degeneration occur usually isolated, rarely in small collections. They correspond to the hyaline degenerated cells found in other chronic inflammations of the mucous membrane.

Glanders. This affection appears in the nose and larynx, usually in the form of nodules and nodes, more rarely as diffuse infiltrations consisting of closely appressed round cells without giant cells. The nodules suppurate rapidly, and the component polynuclear leucocytes exhibit fragmentation of their nuclei. In the neighborhood of the nodules the tissue shows frequently hemorrhagic infiltration. If the nodule lies in the neighborhood of the surface of the mucous membrane there occurs early an infiltration of pus corpuscles into the epithelium, as the result of which small pus foci arise. Later these foci coalesce and give rise to the formation of ulcerations. During the early stage of the nodule many bacilli lying more or less in groups are found in it. When the nodule suppurates, however, the number of bacilli diminishes, and in chronic glanders they are not to be demonstrated microscopically.

Chronic Inflammations with Tendency to Hypertrophy. Chronic inflammations of the upper air passages may be divided histologically for purposes of convenience into, first, superficial inflammations of the mucous membrane; second, inflammations affecting the parenchyma; third, inflammations involving also the periosteum or perichondrium and bone. Such divisions are to a certain extent arbitrary, since different degrees of the affection may be found in the same tissue in adjoining places. In spite of the apparently distinct picture presented by these processes in the nose, pharynx, and larynx, a definite morphological unity is revealed by a histological study. Although an account based upon the regional distribution of these alterations necessarily involves the repetition of histological terms to a considerable extent, it appears better adapted to present clearly our existing information. We shall therefore consider the changes as they occur in their different points of localization in the nose, nasopharynx, pharynx, and larynx.

Nose. In superficial inflammation an infiltration of mononuclear neutrophiles and plasma cells occurs in the adenoid layer and in the vicinity of the basement membrane, localized particularly around the smaller bloodvessels and the efferent ducts of the glands. Mastzellen are usually present, and there is an increase in the number of cells showing colloid degeneration. The papillæ of the mucous membrane may be lengthened into wart-like prominences, as the result of three factors: first, proliferation of the fibrous tissue; second, proliferation of the columnar cells of the surface and of the cells of the ducts of the glands by segmentation parallel to their long axes; third, a dilatation of the chief ducts of the glands and their communicating acini. This combination of phenomena produces the mulberry hypertrophies of the inferior turbinated bone. Associated with these changes is the presence of a certain amount of œdema in the tissues, most marked in the anterior end of the middle turbinate and in the sinuses, giving rise to the circumscribed hypertrophies known as *polypi.* The stroma of these growths consists of a more or less loose connective tissue, the meshes of which contain round cells and albuminous fluid. They are covered by a cylindrical epithelium which, in places exposed to external irritation, tends to become altered into pavement epithelium. The glands of the growth may be increased in number, having in the majority of cases the character of mucous glands. At times there occur with them so-called serous glands. The acini of the glands often show cystic dilatation, which may at times be so marked as to form a cyst occupying the greater portion of the polyp. (Fig. 359.)

Fig. 359.



Hypertrophic inflammation of middle turbinate. Below the columnar epithelium is a loose œdematous connective tissue with scattering bloodvessels and efferent glandular ducts. Below this is a denser connective tissue with mucous glands, bloodvessels, and infiltrating cells. The bone presents irregular thickenings and processes characteristic of hyperplastic periostitis.

Two forms of degeneration are found in the chronic inflammatory processes under consideration, first, mucous degeneration of the epithelium of the surface and of the ducts of the glands; second, a colloid or hyaline degeneration of the migratory cells of the connective tissue.

Where the inflammation is more deeply situated the infiltration extends to the glandular layer and to the periosteum, frequently infiltrating the germinal layer of the latter. All the medullary spaces are more or less completely filled with a compact cellular infiltration, particularly in the vicinity of the vessels. Clinically this deep inflammation comprises cases of marked degeneration of the middle turbinate and chronic ethmoidal sinusitis. In such cases the inflammation has probably extended from the periphery into the deeper portions of the tissue and the medullary spaces.

Ethmoiditis. The inflammations of the bony tissue in the nose are observed in the ethmoidal labyrinth in two forms, first, a distinct new formation of bone; second, an absorption of bone. New formation of bone is the result of proliferation of the germinal layer of the turbinate. Large nucleated cells are separated from the infiltrated germ layer and deposited as an osteoblastic layer upon the old bone. From this osteoblastic layer a compact intermediate substance or osteoid tissue is formed over a large portion of the protoplasm of its cells, which encloses the rest of the osteoblasts in irregular cavities divided by prolongations. This osteoid tissue lies partly diffuse, partly in circumscribed prominences on the old bone, giving rise to a diffuse thickening of the latter or to prickle-like bony excrescences. The new formation of bone constantly progresses by the deposit of new layers of osteoblasts on the osteoid tissue. In the same way there may be observed a new formation of bony substance proceeding from the medullary cavities by adhesion of the cells of the medulla to the old bone as an osteoblastic zone, which after the formation of an intermediate substance becomes osteoid tissue. Here and there the medullary spaces appeared narrowed by the new-formed bone. Clinically these cases are characterized by diminished resistance and a crackling sound when the tissues are touched with the probe.

The other alteration in which absorption or rarefying osteitis occurs, is characterized by the occurrence of numerous giant cells or osteoclasts in excavations of the bony lacunæ. These vary in number according to the degree of absorption which is taking place. The trabeculæ become generally thinner by the erosion of the osteoclasts, so that the medullary spaces continually increase in size, and the bony trabeculæ become thinner. In advanced stages the erosion of numerous trabeculæ may result in the coalescence of adjoining medullary spaces, producing a cavity which by continued progression in the process may become a bony cyst. Such a cyst is usually lined with columnar ciliated epithelium, contains no glands in its interior, but a certain number of arterioles, veins, and microscopic erectile tissue.

It is difficult to state why in one case hypertrophy of the bone predominates and in another absorption. It is possible that the inflammatory infiltration which penetrates the substance of the turbinates may lead in some places to a stasis from compression of the veins. On the other hand, a congestion of the periosteum excited by the infiltration may produce hypernutrition by which the hyperplastic growth arises.

In a few instances polypi have been found containing bone. In most of them it was found that a single bony tube extended through the whole polyp, although in some cases there was a branching, beginning at the point of attachment of the pedicle. These tubules showed a well-developed medulla. The condition, therefore, was an actual hyperplastic structure due to a proliferation of the periosteum of the turbinate in association with rarefying osteitis.

Neither rarefying osteitis nor hyperplastic bony alteration is essential to the formation of polyps. The polyp is an œdematous hypertrophy of the mucous membrane in which, just as in the case of firm hypertrophy, the process may be limited to the superficial layers or extend to the depths. It is wholly immaterial whether this inflammatory hypertrophy is excited by a diffuse catarrhal involvement of the whole nasal mucous membrane or of only a portion of it, or by an empyema.

In nasal polypi the existence of nerves has been demonstrated, although in general these structures are poor in nerve fibres. They are characterized by several peculiarities, extending over long distances without giving off lateral branches, the nuclei showing a narrow and elongated, somewhat irregular shape, lying extremely close to the nerves, so as to give the impression of forming a swelling of the nerves themselves. From the course of the nerve fibres and the peculiar arrangement of the nuclei, it is apparent that we have to do with newly formed nerve fibres. Granular cells and individual terminal corpuscles were not observed. The fibres terminate in the tissue of the polyp itself, and do not extend into the epithelium.

Hyperplastic Perichondritis and Periostitis of the Septum. The anatomy of spurs and deviations of the septum does not come within the present consideration. Certain histological lesions are, however, common to all the varieties, chief among which may be mentioned hyperplastic perichondritis and periostitis. Examination of a septal spur or of a healed fracture of the septum shows in many cases at the point of convexity a heightened proliferation of the cells of the perichondrium or periosteum. In the case of cartilage, the linear nuclei of the germinal layers increase in thickness, becoming triangular or stellate. Simultaneously the protoplasm of the cell is observed to retract from the cell wall and become gathered around the nucleus, with the result of creating an elongated or oval deficiency in the cell. The acidophilic fibrous tissue in the vicinity becomes at the same time more homogeneous and translucent, and assumes a distinct tinge with basic dyes. These phenomena occur irregularly at the margin of the cartilage, with the result of producing prolongations and excrescences of the intermediate chondroid tissue. As the latter becomes older the cells resemble more and more those of true hyaline cartilage.

In the case of bone analogous alterations are found to occur, the details of which have been previously described in the account of hyperplastic periostitis of the ethmoid. At the line of fracture the fragments are separated by fibrous tissue traversed by bloodvessels of varying size. In this situation the proliferation of the perichondreal and periosteal layers produces a diffuse deposit of the intermediate substance. The writer has observed the formation of a sesamoid fragment of cartilage at the apex of convexity of a traumatic deviation of the septum situated in the fibrous tissue between the mucous membrane and the line of apposition of the fragments. The mucous membranes covering the convexity of the deviation consists of stratified pavement epithelium, below which is a mucosa showing more or less tendency to papillary hypertrophy, except at the apex of the convexity. In this region a thinning of the mucous membrane frequently occurs, and there is no evidence of glands

Hypertrophy in the Nasopharynx and Pharynx. Chronic inflammations of these two regions may be advantageously considered together. We may make a secondary division into chronic inflammations of the lymphoid tissue and of the mucous membranes. Although these two structures are usually affected simultaneously or in association, an independent involvement of each may occur.

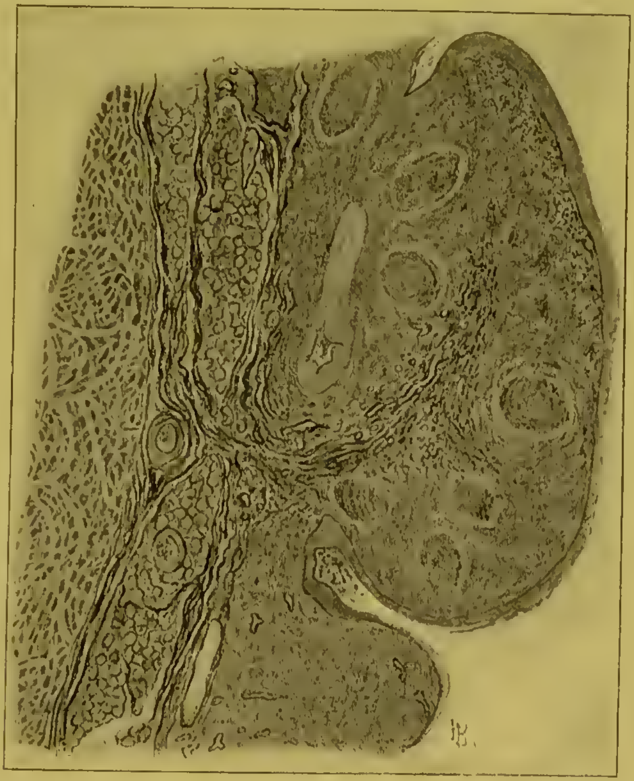
The lymphoid structures comprise the pharyngeal tonsil, the collections of lymphoid tissue in the vicinity of the Eustachian tubes, the faucial tonsils, and the lymphoid tissue on the posterior pharyngeal wall. Chronic inflammation of these lymphoid structures presents histologically essentially identical pictures. In all we have to do with a unit of structure, the lymphoid follicle, covered with mucous membrane of varying character, which in places where the follicles are aggregated in large numbers sends down invaginations between them. The phenomena represent a heightening merely of the normal processes, in that the endothelial cells of the reticulum are seen to proliferate more actively, giving rise to epithelioid cells with phagocytic properties. The follicles exhibit an enlargement, as the result both of an increased number of their lymphoid cells and the endothelial cells of the reticulum. The mucous membrane of the crypts appears looser and with larger interspaces than normal. Lymphoid and plasma cells are found here in unusual abundance making their way into the crypts. The crypts are filled with amorphous detritus, exfoliated epithelial cells, leucocytes, and bacteria.

In comparing the pictures presented by chronic lymphoid hypertrophy with those seen in acute inflammation, it is to be noted that in the former condition the alterations consist pre-eminently of endothelial proliferation with but relatively slight increase in the number of lymphoid cells, while in the latter instance the reverse is the case, and although we see here increased endothelial proliferation, the enormously increased number of lymphoid cells in the follicles and adjoining lymph sinuses and crypts gives the characteristic feature of the picture.

The histological changes which have just been described as occurring in the faucial tonsils are repeated without essential points of difference in the pharyngeal and in the lingual tonsil.

The chronic inflammations of the pharyngeal mucous membrane have not been studied histologically with the same degree of care as analogous changes affecting the larynx, and our histological information is so meagre that it seems better to refer the reader to the account of chronic diffuse hypertrophic laryngitis, the histological description of which may be assumed to apply to the processes in the pharynx.

FIG. 360.



Posterior pharyngeal wall at the level of the velum, stained with Weigert's resorcin fuchsin stain for elastic fibres. On the right lymphoid tissue is seen, consisting of numerous follicles separated by connective-tissue trabeculæ. These fibres proceed from the elastic limiting partition of elastic fibres separating the muscles of the part from the overlying tissue.

Chronic Inflammation of the Pharyngeal Recess or Bursa. It is probable that independent inflammatory disease of the bursa pharyngea is extremely rare. The so-called Tornwaldt's disease, a name which was applied to chronic catarrhal inflammation of the structure in question, has been shown not to occur, at least the use of this term has been greatly restricted. Catarrhal processes of the nasopharynx involve either the whole mucous membrane of the vault, or certain clefts in the mucous membrane, by preference the central cleft of the adenoid, which is also the deepest as a rule. The fossæ of Rosenmueller may retain secretion to a marked degree, particularly when they are divided by folds. Cases occur of atrophic catarrh localized exclusively in the vault of the pharynx.

Chronic Laryngitis. Under the influence of recurrent attacks of acute catarrh, the mucous membrane of the larynx is prone to take on hypertrophic changes, which vary markedly according to the points of localization. The small-celled infiltration deposited by the acute inflammation, as the result either of unhygienic surroundings or abnormal conditions of the patient, does not attain complete absorption, but becomes associated with the proliferation of connective tissue. Each attack increases the formation of new tissue. The histological manifestations are essentially similar in all the forms, the special features of each of these being given by its localization. Although the process of chronic inflammatory hypertrophy may affect the larynx diffusely, it is apt to attain its greatest development in one or more circumscribed regions. From the anatomical standpoint we may therefore distinguish:

Chronic diffuse hypertrophic laryngitis.

Hypertrophy of the tissue lining the ventricles (so-called prolapse of the ventricles).

Pachydermia of the vocal cords.

Polyp of the cords.

Vocal nodules.

Subcordal hypertrophy.

Chronic Diffuse Hypertrophic Laryngitis. The inflammatory alterations are situated chiefly in the connective tissue beneath the epithelium, reaching their highest development in the vicinity of the bloodvessels and the efferent ducts of the glands. They may also give rise to a thickening of the perichondrium and cartilage. The epithelium may undergo metaplasia into a stratified pavement epithelium, which in advanced cases may consist of from fourteen to twenty epithelial layers. The epithelium is everywhere infiltrated with leucocytes, most abundantly in those places where the underlying tissue exhibits especial infiltration.

The membrana propria may become thickened and distinctly fibrillary. Below the stratified cylindrical epithelium the papillæ of the mucosa exhibit proliferation, branching, and multiform circumscribed prominences. The connective tissue of the papillæ is soft, poor in fibres, and exhibits a marked diffuse infiltration with leucocytes. The submucosa shows alterations which vary in different places in intensity. It appears hard, compact, markedly fibrillary, containing only a few spindle cells. The round-celled infiltration appears at times diffuse, at others circumscribed in the form of nodules, most conspicuously around the efferent ducts of the glands. Some of the cells exhibit hyaline degeneration. The bloodvessels are in general large and thin walled, well filled with blood, except where the mucous membrane has undergone fibrous changes. The mucous glands may exhibit hyperplasia. The epithelial cells may exhibit a high degree of mucous degeneration. The perichondrium in the regions corresponding to the most marked alterations of the mucous membrane may be infiltrated with leucocytes and show a hypertrophy of the cartilage.

Hypertrophy of the Ventricular Region. This condition consists histologically of marked hyperplasia of the connective tissue of the ventricle of the larynx, which extends also to the upper aspect of the vocal cord, and is frequently associated with pachydermia of the vocal cords. The histological details may be inferred from the preceding description of chronic diffuse hypertrophy.

Pachydermia of the Vocal Cords. Pachydermia of the vocal cords consists histologically of an inflammatory hypertrophy of the connective tissue of the mucosa, affecting subsequently the epithelium. This is particularly evident in those places where the process is able to develop undisturbed by external influences. Histologically the epithelium is seen to be thickened and horny in its upper layers, which are formed by flat cells with indistinct nucleus or without a nucleus. Among them there occur layers of cells in which keratohyaline may be encountered. The lowest layers of the epithelium, which are situated upon the connective tissue, are composed of cylindrical cells. Between these and those which bear keratohyaline are layers of polygonal cells with prickle processes and deeply-staining nuclei which correspond to the rete Malpighii of the external skin. These horny alterations occur not only in the vocal cords and those portions of the larynx which normally bear pavement epithelium, but also in other regions covered with columnar epithelium, as for instance, in the ventricular bands or ventricles. These latter situations may exhibit a transition from the columnar to the pavement epithelium.

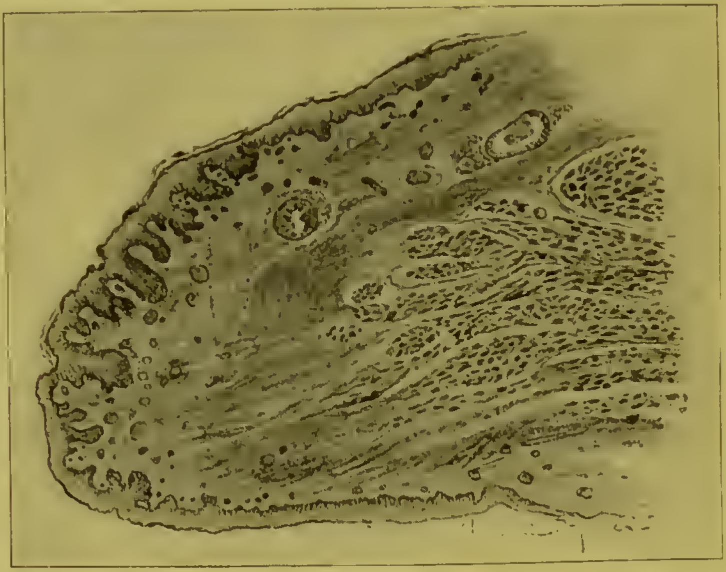
On the free surface of the vocal cords there occur in pachydermia, in addition to the normal folds, actual papillæ, which may penetrate higher into the thickened epithelium than the level of the normal folds. These are particularly well developed in the region of the vocal processes. While the connective tissue thus sends papillæ into the epithelium, the epithelium in turn penetrates the connective tissue with interpapillary prolongations which may be divided into several summits.

The subepithelial layers of the connective tissue exhibit an increase in the number of round cells, particularly in the neighborhood of the glands. The cells may penetrate the cylindrical epithelium of the latter and fill the lumen of the efferent ducts. Keratohyaline is apt to occur together with the formation of papillæ, thus giving the tissue an epidermoid character.

The origin of the depressions at the summit of the pachydermal swellings on the vocal process is not wholly clear. In cases which have been investigated histologically the depression in the centre of the swelling is seen to correspond exactly to the point of the hyaline cartilaginous process. This latter is surrounded by hypertrophied connective tissue, which around the point of the cartilage is prolonged upward into papillæ covered with a thick layer of pavement epithelium forming the margin of the growth in question. Virchow believes that the depression occurs from the closer approximation of the mucous membrane to the point of the cartilage in the centre of the growth, rather than at the periphery. Fraenkel explains it by the mutual pressure exerted by the vocal processes during phonation.

Ulcerative processes are apt to occur in pachydermia, most cases being of long duration. They begin in all cases from the surface, and perhaps occur by the rubbing of the apposed portions of the mucous membranes on each other. Perichondritis may be observed in association, but its relation to the ulcerative process is not clear.

FIG. 361.



Vocal cord, normal.

It is possible that some of the cases reported owe the origin of these processes to tubercular or syphilitic or typhoid infections.

Polyp of the Cords. By this term is denoted a circumscribed hypertrophy of the mucous membrane of the vocal cord associated with œdema. The hypertrophy affects all the superficial layers of the cord, and is therefore distinguished from fibroma, which is a totally different structure and consists of connective tissue covered with mucous membrane. In the polyp, on the other hand, the individual constituents (namely, connective tissue, elastic tissue, glands, vessels, and epithelium) bear the same relationship to each other as in the mucous membrane of the vocal cord, and no one constituent predominates over the others.

The polyp exhibits a loose large-meshed connective tissue. Some of the meshes are so large as to give the appearance of cysts, but are not true cysts, since their walls consist of connective-tissue fibres without endothelial lining. These cyst-like dilatations may occur at the base of the growth, and also immediately under the epithelium. Next to the connective tissue the elastic tissue takes up a large portion of the laryngeal polyp, in some instances being even more abundant than the white fibrous tissue. Glands are usually present. The epithelium varies in thickness from two to many layers, even at times being so thick as to deserve the name of pachydermia. It consists of stratified pavement epithelium which may at times be horny and may contain epithelial pearls. Epithelial pockets are sometimes found in the form of round or oval cavities under the epithelium. In most cases the basement membrane marks the line between the epithelium and the connective-tissue portion of the tumor.

The degenerative processes in the tissue of the laryngeal polyps are somewhat complicated. As the result probably of stasis of the blood and lymph there arises a homogeneous infiltration with pigment and thrombosis, leading finally to the formation of peculiar homogeneous, opaque, hyaline, yellowish, or brown masses penetrated by small irregular cavities.

Vocal Nodules. Some confusion exists with regard to the nature of the so-called vocal nodules. Three hypotheses have been brought forward:

1. A physical, namely, mechanical friction of the margins of the cords at points determined by the conditions which cause swelling in the vocal cords.

2. A physiological, the vibrating nodes of the vocal cords, being points of the most violent action, are predisposed to the formation of the nodules.

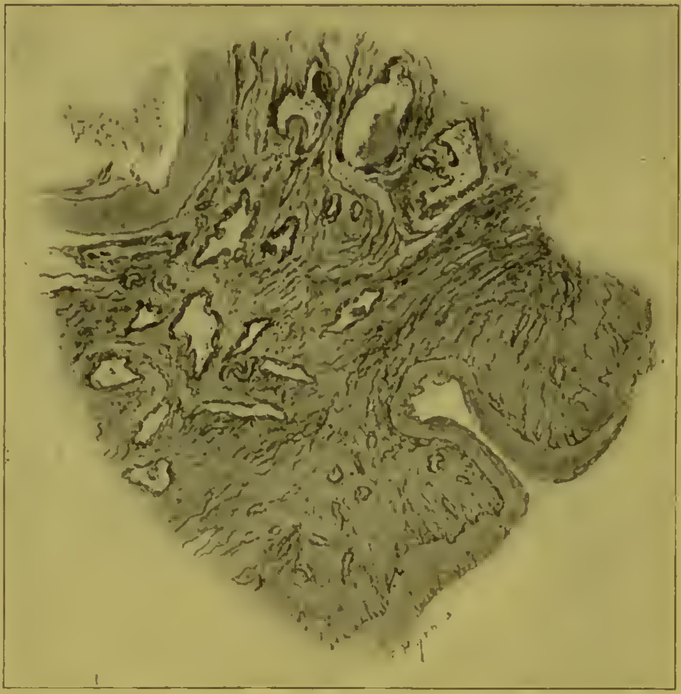
3. An anatomical, the vocal nodules stand in relation to a gland situated at the posterior end of the free portion immediately under the margin of the cord.

The present consideration is limited to those cases dependent upon a hypertrophy of the epithelium. The swellings exhibit stratified pavement epithelium ranging in thickness from 100 to 400 μ, due to a considerable increase in the layers of polyhedral and cylindrical cells. At the level of the polyhedral layer the protoplasmic substance is well marked, the nuclei are large, and stain well with carmine. The cells are intimately connected with each other by a protoplasmic substance and prickle cells, without the interposition of leucocytes. The mucosa is composed of fusiform cells with bipolar prolongations, which one may follow over an extent of 60 μ. The deeper layers of the section show a few strands of elastic fibre. There is no actual papillary layer present. The fibro-elastic mucosa is thickened and distinctly less vascular than normal. In some cases a process of degeneration and cyst formation occurs.

Hypertrophic Subglottic Inflammation. Chronic inflammatory hypertrophy occurs at times in the subglottic regions of the larynx and in the trachea in the absence of tuberculosis and rhinoscleroma, probably as the result of recurrent acute inflammations which do not attain complete absorption. The anatomical basis of the affection is similar to that described in chronic diffuse hypertrophic laryngitis, consisting of an increase in the mucous and submucous connective tissue, with a tendency to metaplasia of the epithelium into stratified epithelium, and leading in severe cases to stenosis of the larynx.

Chronic Inflammations with Tendency to Atrophy. We may recognize two essentially distinct forms of the atrophic process in the nose and throat, first, a genuine fetid atrophic rhinitis, nasopharyngitis, and laryngitis; second, a localized dry anterior rhinitis.

FIG. 362.



Atrophic inflammation of the middle turbinate. Below the stratified pavement epithelium is a comparatively dense network of connective-tissue fibres, showing round-celled infiltration with scattered bloodvessels. Below this are irregular sinuses in a compact mass of connective tissue.

By diffuse atrophic inflammation is denoted a chronic inflammatory affection characterized clinically by a more or less general progressive atrophy of the mucous membrane and underlying structures, the formation of a tenacious, at times fetid secretion, and exhibiting no tendency to spontaneous recovery. Our histological information is derived from a study of the lesions occurring in the nose.

In diffuse fetid atrophic rhinitis we find histologically a metaplasia of the epithelium associated with cornification, degenerative changes in the glands and in the wandering cells, together with bony absorption.

Examining these alterations more in detail, we find in the first instance the normal columnar ciliated epithelium to be more or less universally replaced by stratified pavement epithelium, with a tendency to horny changes in the upper layers. Below the mucous membrane there is an infiltration of round cells, particularly in the adenoid zone, extending more or less deeply into the region of the glands, particularly in the intertubular tissue. In the vicinity of this infiltration are found numerous fibrillary nucleated connective-tissue strands, running usually parallel to the surface, and varying in number according to the duration and stage of the affection. Confusion exists between the statements of different observers as to certain manifestations in the mucous membrane and infiltrating cells. Fatty degeneration of these cells has been observed and is by some regarded as the essential feature of the process. It appears now reasonably certain that while fat drops may occur in the glandular epithelium and sometimes in the free epithelial cells as far as the orifice of the efferent duct on the surface, nevertheless similar alterations may occur in all nasal affections without associated fetor or atrophy. It is possible that another process of degeneration which occurs here, namely, hyaline metamorphosis of the plasma cells, may have led to erroneous conclusions by earlier observers. These hyaline degenerated cells, the so-called Russell's fuchsinophiles, are found not only in the subepithelial layer, but also in the deeper layers of the mucosa, in the erectile tissue, and in the medulla.

The erectile tissue shows a gradual weakening of its muscular apparatus, and in advanced stages distinct shrinking. E. Fraenkel has described an endarteritis obliterans, but his findings have not been confirmed.

The periosteum in the affected portions shows marked proliferation, with here and there an increase in thickness. Large polynuclear cells are found in varying numbers, the so-called osteoclasts, lying generally directly on the margin of the bone and the lacunæ. In their vicinity there is evidence of bony absorption, with the result that the bony partitions supporting the adjacent medullary spaces gradually disappear. Small pieces of bone are split off and absorbed. There thus takes place gradually a loss of the bony framework of the turbinated bones. Howship's lacunæ are found in varying abundance. At times no osteoblastic layer is found. These alterations are possibly instrumental in altering the nutrition and circulation in the bone. By some observers they are regarded as constituting an independent primary process, which leads through alterations in the arteries to secondary changes in the overlying structures.

The attempt was made some years ago to explain the causation of atrophic rhinitis by the presence of a specific bacterium. Several organisms were isolated and claimed by the discoverers as the specific agents. It is sufficient at the present time to state that no confirmation of these claims has been established. Its origin from chronic sinusitis with empyema seems probable in some instances.

Rhinitis Sicca Anterior. By this term we understand an affection of the mucous membrane of the cartilaginous septum presenting a picture of dry catarrh leading to epithelial metaplasia, and frequently to bacterial infection. The mucous membrane in the affected region exhibits one or more layers of a peculiar substance situated above and upon the superficial cell layer, which shows in its tinctorial reaction a resemblance to keratohyaline. In and below the mucous membrane are numerous hyaline degenerated plasma cells, mastzellen, and a few eosinophilic cells. A large amount of pigment, probably hæmatogenous (staining reddish brown with carbol fuchsin), is distributed in the mucous membrane, partly in and partly external to the cells.

This condition is the most important etiological factor in habitual nose-bleed and in perforating ulcer, probably also for perichondritis of the septum.

2. PROGRESSIVE DISTURBANCES OF NUTRITION.

Under this heading are comprised alterations characterized by progressive non-inflammatory increase in tissue volume. We distinguish new-growths with malignant tendency and new-growths of a benign character, the first growing into the tissues of the vicinity, forcing them to one side and actually replacing them, while the latter remain relatively well differentiated in their growth from the vicinity.

Malignant Tumors. Of these we may distinguish two chief types, according as they rise from the ectoderm (or entoderm), or from the mesoderm, the former being represented by carcinoma, the second by sarcoma.

Carcinoma. These growths arise through proliferation of the superficial epithelium, or the glandular epithelium which grows into the neighboring connective tissue and produces here a simultaneous proliferation. For these reasons carcinoma has two constituents, namely, cancer cells and a vascular stroma. The cancer cells appear morphologically as large cells possessing large round or oval vascular nuclei with large refractile nucleoli. They preserve to a certain extent the arrangement and form of the mother cells. The stroma varies in consistence and thus influences the density of the tumor.

Carcinomata are divided into epitheliomata and adenocarcinomata, the first arising from squamous, cylindrical, or tubular epithelium, and the second arising from the lining epithelium of the various glands. In the case of the epitheliomata, but little confusion can arise as to the question of their malignancy. In adenocarcinoma, on the other hand, there is frequently a striking resemblance to a genuine adenoma. We find all degrees of transition, from localized hypertrophies, in which all the constituents of the mucous membrane are involved, to papillomata and adenomata, and finally to carcinomata. The only sharp line of demarcation between the benign and malignant growths in this list is in the tendency of the latter alone to invade the tissues of a different blastodermic origin.

Both epithelioma and adenosarcoma occur in all parts of the upper air passages. In the nose carcinoma is comparatively rare and usually of the glandular type. In the pharynx and larynx epithelioma is more frequent.

Sarcoma. These tumors consist to a greater or less extent of immature forms of connective tissue produced through proliferation of cells of mesodermal nature. The cells are usually numerous, and exhibit great variation in number, size, and shape. The ground substance may range from one but slightly developed and apparently amorphous, to one that is more abundant and compact and more or less fibrillary, approaching in its appearance the mature connective tissues. Many sarcomata exhibit an alteration of a portion of their tissues into a mature connective tissue, such as bone or cartilage. The development of bloodvessels is at times extremely marked, as in angiosarcoma. Retrograde metamorphoses occur in sarcomata under the form of fatty degeneration, caseation, liquefaction, and ulceration. Histologically, the following varieties are distinguished: First, round-celled sarcoma, where the growth is made up of round cells with a small amount of intermediate substance. The size of the cells varies, giving small round-celled sarcoma and large round-celled sarcoma. Second, spindle-celled sarcoma, consisting of elongated cells, large or small, with a very slight development of intermediate substance. Third, endothelial sarcoma, arising through proliferation of the endothelial cells, particularly of the lymph vessels. Fourth, angiosarcoma, which includes the forms which are particularly well supplied with bloodvessels. Sarcomatous tissue surrounds the vessel walls, which may exhibit irregular dilatations, giving a hyaline degeneration which may result in complete closure of the lumen. Hyaline cylinders and knob-like protuberances are thus produced, forming the so-called cylindroma. Melanotic sarcoma is a form in which a portion of the cells contains a brownish or black pigment. The form of the cells is immaterial. These growths exhibit marked malignancy.

Sarcoma may exhibit a combination with the mature tissue of the mesoderm, giving osteosarcoma and chondrosarcoma.

Sarcoma may occur in all regions of the upper air passages. They are found with particular frequency in the nose, while in the larynx they are of extremely rare occurrence.

Benign Tumors. Of these we distinguish genuine tumors and tumors arising from stasis.

True tumors may arise from the ectoderm, producing papilloma and adenoma, or from the mesoderm, giving fibroma, lipoma, myxoma, chondroma, osteoma, and angioma.

Papilloma. This variety of tumor is characterized by the presence of numerous fibrous branches covered by epithelium. In the nose this epithelium becomes atypical and approximates the squamous type in those situations where it is exposed to external irritation or rubbing of its surfaces. Everywhere the marked feature of the growth is the proliferation of the epithelium. The stroma is scanty and abundantly supplied with bloodvessels. In spite of its similarity to cancer, on account of its tendency to active atypical proliferation, the non-malignant character is shown by the fact that the epithelial covering of the tumor is sharply limited below and does not at any place penetrate the underlying tissue. The growth is always to be distinguished from papillary hypertrophy, in which all the elements of the mucous membrane participate.

Adenoma By this term is denoted a tumor which imitates the physiological glandular tissue in a certain degree, but does not exhibit its function. Although the adenoma resembles the normal structure of the gland it differs always to a greater or less extent, partly in the size and partly in the arrangement of the epithelium. Their line of demarcation from simple glandular hyperplasia is by no means sharp, nor, on the other hand, are they definitely separable from adenocarcinoma. The chief points of distinction in the latter case consist in the regular arrangement of the epithelium and the sharp separation of the adenoma from its surroundings. Pure adenoma in the nose is rare. It is more frequent in the palate, where it is often associated with a dilatation of the lymphatics. It is rare in the larynx.

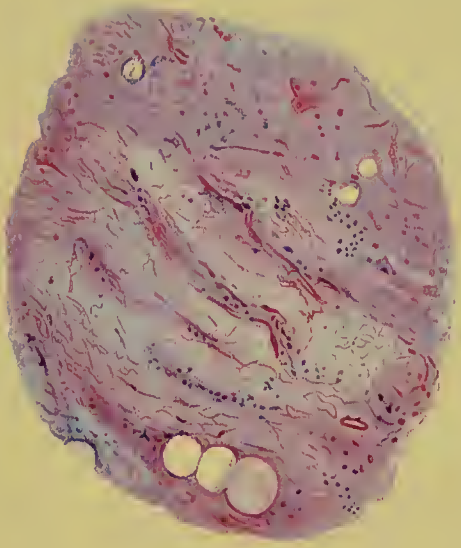
Fibroma. This growth consists of fibrillary vascular connective tissue of a more or less compact structure. In the septum it occurs at the junction of the columnar and triangular cartilage, and shows an epithelial covering with the characteristics of the external skin, overlying firm, fibrous, closely-appressed bundles which contain numerous spindle-celled elements, but few round cells and bloodvessels.

In the nasopharynx we see all gradations, from the pure fibromata, consisting almost entirely of dense white fibrous tissue, to those of a looser structure with more numerous cells and bloodvessels, which approach in type the fibrosarcoma. In the larynx the true fibroma is rare, and is found chiefly on the vocal cords.

Lipoma. These have been observed upon the mucous membranes of the nose, the tonsils, and the larynx. They consist in their centre of fat tissue surrounded by a more or less abundant connective tissue in the peripheral portions, and are covered by the mucous membrane of the part. They are apt to be associated with other growths, particularly fibromata and myxomata. The fat tissue in these growths is distinguished from normal fat tissue in the greater size of its cells and lobules. It may be associated with greater development of fibrous tissue, producing a fibrolipoma.

Myxoma. True myxoma has not been reported from the nose. It rarely occurs in the larynx, consisting of a homogeneous ground substance with delicate fibrillæ containing mucin in the meshes, together with stellate anastomosing cells.

PLATE XXIII.



Myxoma of Larynx.

Fat-globules, mucin and branching cells are shown.

(Dr. Jonathan Wright's specimen.)

Chondroma. These growths consist of cartilage, most commonly hyaline cartilage, although yellow elastic, and fibrocartilage may occur. In the nose they are extremely rare, and are either supposed in some cases to begin as pedunculated outgrowths which, by disappearance of their pedicle, become free, or in other cases to arise from islands of cartilage which persist from fœtal life. In the larynx they may occur as ecchondromata of the same form as the parent tissue, or as chondromata, in which the type of cartilage is different. These growths are prone to retrograde metamorphosis in the form of mucous degeneration. They may also exhibit calcification or actual ossification.

Osteoma. These growths in the nose are supposed to arise in one of the accessory sinuses, and are composed in their outer layers of compact osseous tissue, although the interior may be made up of spongy tissue. They are apt to be broken off from their point of attachment either by traumatism or by atrophy from pressure, perhaps resulting from the occlusion of the nutrient bloodvessels.

Angioma. These growths are found chiefly in the nose and larynx. We distinguish simple and cavernous angiomata. The simple angioma consists of numerous capillaries and veins which exhibit circumscribed dilatations in the form of globular, fusiform, or cylindrical enlargements. These are closely related to the so-called bleeding polyp, a form of tumor which is characterized by an excessive, simultaneous, sudden growth, and is essentially benign, although apt to recur. The hypothesis of Siebenmann, that it is due to rhinitis sicca anterior, is at present plausible, but not demonstrated with certainty. The epithelial covering consists partially of stratified cylindrical epithelium, the lower layers of which are composed of large polygonal nucleated cells, from which the upper layers are sharply separated, being flattened and distinctly horny. The pavement epithelium is not symmetrically distributed over the surface of the new-growth, but sends downward slender papillary prolongations. The main portions of the growth consist of a loose connective tissue formed at its base of delicate fibrillæ. Toward the periphery the round cells are more abundant. In the middle infiltrated portion are numerous dilated blood and lymph vessels, giving rise almost to a cavernous appearance.

Angioma cavernosum resembles the above growth, but shows particularly a new formation of the vessels, which undergo secondary dilatation. They are situated exclusively on the lower turbinate or septum, and consist histologically of a covering of stratified ciliated epithelium overlying the cavernous blood spaces, separated from each other by trabeculæ. These sinuses are round or oval, and lined with smooth endothelial cells. In the deeper portions they become larger and more irregular, and the septa exhibit a greater thinning, and finally rupturing of their walls, leading to a confluence of the adjacent sinuses. Both venous and arterial bloodvessels show a thickening of their walls.

A third form of these vascular growths is the fibroangioma, which exhibits a smooth surface bearing stratified ciliated epithelium overlying a body of firm fibrillary connective-tissue strands, and containing numerous irregular sinuses resulting from dilatations of the veins or arteries, which, from erosion of the trabeculæ, may become confluent. There is everywhere a round-celled infiltration, particularly in the vessels.

Retention Tumors. **Retention Tumors of the Epithelium; Cysts.** In the nose, cysts of varying size occur, most frequently in polypi and in the antrum, resulting from the occlusion of the efferent glandular duct, with resulting dilatation of the gland. Such cysts are lined with epithelium and contain mucus. In the septum a cystic enlargement is occasionally found as the final result of a hæmatoma, which in place of suppurating becomes encapsulated, and is found to contain a fluid which is either clear and transparent, or fine, granular, and viscid, or at times shows the reaction for colloid.

In the nasopharynx a form of cyst occurs which is supposed to arise as the result of inflammatory processes affecting the pharyngeal tonsil, leading to adhesion of the surface of the median folds and converting the median furrow into a canal open at both ends. When the mouth of this canal becomes closed a retention cyst may be formed of varying dimensions. It is possible for this to occur in other parts of the pharynx where the folds of the pharyngeal tonsil lie in close apposition. Lamphear reports a case in which the mass on microscopic examination was found to possess a wall, the outer and inner surface of which was covered with stratified pavement epithelium. The inner surface was smooth, except at its attachment to the pharynx, where there were a few crypts. The mucous membrane was rich in lymph corpuscles, but there were very few lymph follicles.

In the tonsils cystic growths may arise from the occlusion of a lacuna following inflammation or tonsillotomy. The walls of such cysts are formed of flattened epithelium, and the contents consist of fat drops, plates of cholesterin, exfoliated epithelium, and leucocytes.

In the larynx cysts have been observed in the various ligaments as the result of glandular occlusion. In polyps of the vocal cords there may occur genuine cysts, or pseudocysts due to œdematous infiltration in a circumscribed area. In the latter instance there is no lining epithelium, the walls of the cyst being formed by the hypertrophied connective tissue. Cysts of embryonal origin also occur in the larynx, due either to the occlusion and dilatation of the thyrolingual duct or to a persistent branchial cleft, which may give rise to superficial fistulæ, which are later transformed into cysts by closure of the openings at the extremities.

Retention Tumors of the Mucosa. Of these we distinguish dilatations of the bloodvessels and of the lymphatics.

Retention tumors of the bloodvessels from stasis occur most frequently at the base of the tongue as lingual varix. We have no exact histological knowledge of this condition, but it is probably analogous to similar lesions upon the skin.

Tumors of the lymphatics from stasis, or lymphangiomata, have been reported from the pharynx and larynx. In a case of lymphangioma of the epiglottic ligament the tumor was seen to consist of a wide-meshed, loose, vascular, connective tissue containing many cavities, varying in size up to 1 mm., possessing a thin lining of endothelium, and filled with a homogeneous mass containing a few round cells. In many places in the connective tissue these same masses occur. The tumor-like formation is in general sharply differentiated from the surrounding tissue.

4. REGRESSIVE DISTURBANCES OF NUTRITION.

These alterations in the upper air passages consist of degenerative and of atrophic changes. The most important in this special field are the mucous and horny degenerations of the epithelium, Hoen's muscular degeneration, and hyaline degeneration of plasma cells. Of the atrophic changes the most conspicuous are those occurring in the lymphoid tissue of the nasopharynx and the pharynx.

Mucous Degeneration. Mucous degeneration of the epithelium occurs in the nose both in the superficial epithelium and in the ducts of the glands. It is most commonly found in association with hypertrophic inflammations. The superficial epithelium may become totally or partially degenerated. In the first instance all the cylindrical epithelium is transformed cell for cell into an epithelium consisting of goblet cells filled with mucus. Partial mucous degeneration may occur, either by simple increase of the normal goblet cells, occurring between the cylindrical cells, or by the occurrence of such mucous cells in the recesses of the epithelium, or in the midst of otherwise normal cylindrical epithelium. The epithelium of the efferent ducts of the glands may undergo a similar change. This condition may also occur in ozæna, and also in apparently normal cases. Since it is difficult to demonstrate the efferent ducts in these structures, they may easily produce the impression of purely epithelial formations. (Plate XXI., Fig. 1.)

Horny Degeneration or Keratosis. By this term is denoted a chronic degenerative process of cornification affecting the walls of the lacunæ of the lymphoid tissue in the pharynx, nasopharynx, and base of the tongue, in association with a mycelial organism. (Plate XXI., Fig. 3.)

The structures which appear clinically as white excrescences protruding from the orifices of the crypts are seen histologically to consist of sacs or cylinders, the walls of which are relatively very thick, and consist partially of stratified layers of non-nucleated horny epithelium, and partly of a homogeneous horny substance, such as is peculiar to the human hair. The central lumen of the excrescence or prickle is narrow and filled with detritus and bacteria. In Zenker specimens stained with hæmalum and eosin the horny epithelium stains bright red. The peculiar homogeneous horny substance, on the other hand, appears a clear light blue, here and there with a fine light yellow pigmentation, while in the most peripheral layers red elongated structures indicate that there still remain portions of flat elongated cells or cell nuclei in that part of the prickle which protrudes from the crypt. The external surface appears somewhat shredded, and is here and there invaded with bundles of leptothrix threads.

The epithelium of the surface appears normal both in regard to its total thickness and the appearance of its cellular elements. On the other hand, all the crypts throughout the whole length of their lumen exhibit an enormous thickening of their epithelial cells. In the epithelium of the crypts the cells of all the layers, particularly the middle, appear elongated, and the superficial layers somewhat flattened. The cells which are in contact with the horny plug appear thicker, are stained more deeply, and show a peculiar granulation of their protoplasm. Small, strongly refractile granules, apparently identical with the pigment granules of the homogeneous blue-staining layer, are seen arranged chiefly in regular rows.

Keratohyaline and eleidin are apparently absent.

Keratosis appears frequently in a mild form, in otherwise normal tonsils here and there in the crypts. In the first fœtal months horny epithelial cylinders and epithelial pearls are found in the tonsillar crypts and also in the pharyngeal solitary follicles and the lymphoid tissue of the nasopharynx. The so-called tonsillar concretions are to be regarded chiefly as decomposed products of the cornification in which lime salts have been deposited.

The leptothrix threads which occur in this condition are morphologically identical with the leptothrix buccalis, and are probably here merely saprophytic. This organism occurs with particular abundance wherever epithelial structures experience the loss of vitality, being abundant at times in cancerous ulcerations, leucomatous fissures, and hyperkeratosis of the lingual papillæ.

A Form of Degeneration of Striated Muscle Occurring in the Uvula (Hoen's Degeneration). Histological examination of relaxed uvulæ shows peculiar degenerative changes in the striated muscles associated with marked nuclear proliferation, and leading to a nearly or quite total disappearance of the contractile substance of the affected muscular fibre. In the beginning of the process a peculiar bleb-like or vesicle-like homogeneous deposit takes place at the peripheries of the muscle fibres, appearing as a narrow bright margin or line of homogeneous nature, at times raising the sarcolemma here and there into small blebs or blisters. Transverse striation becomes less marked, and longitudinal striation becomes replaced by wavy undulating lines, corresponding to the individual fibrillæ, which have now become twisted upon this, presenting an appearance not unlike the strands of a rope. This appearance is most noticeable at the free ends of the fibres, and becomes evident only after the marginal change begins to manifest itself. The final stage of the peculiar degenerative process is reached when a veritable cylindrical plug or mass composed of large blebs containing small and large misshaped nuclei intermingled with pigmentary detritus is formed. Through the middle of this there runs longitudinally a mere shadow, denoting the former site of a muscular fibre.

Proliferation and polymorphism of the nuclei are prominent phenomena in this peculiar metamorphosis. Alterations are also apparent in the nuclei, consisting of a flattening at the ends, with a hollow at the central portion on either side, giving them an appearance resembling empty cotton spools. Other nuclei appear elongated with marginal crenations or serrations. The majority of the nuclei show completely surrounding them a halo of a clear homogeneous material which does not stain. With the gradual disappearance of the muscular fibre this material augments in amount and becomes arranged irregularly in the centre of the bleb in small clumps.

Evidences of the regeneration of the muscle fibres have not been observed.

Hyaline or Colloid Degeneration. In both normal and pathologically altered mucous membranes, particularly in hypertrophic rhinitis, there occur at times homogeneous globules, most numerous in those situations which exhibit the round-celled infiltrations. These globules are supposed to arise from plasma cells by a degenerative process which resembles thyroid colloid in its staining reaction. (Plate XXI., Fig. 2.)

In specimens stained with hæmatoxylin and acid fuchsin the nucleus appears dark blue and atrophied. The degeneration begins with a slight swelling of the cytoplasm, which becomes dark and broken. These fragments increase in size, become rounded, more refractile, and stain more deeply with acid fuchsin. The cell, now much enlarged, has the form of a sphere, and many of the fragments coalesce to form larger ones. The atrophied nucleus is usually still visible. Finally there arise completely homogeneous oval structures, staining dark cherry red with acid fuchsin. The advanced stages of degeneration are more commonly found than the early stages. In the beginning their structure is probably plastic, so that through close apposition of the small granules and their coalescence larger granules are formed. It has been assumed that the presence of hyaline and colloid degeneration in the hypertrophied mucous membrane is not accidental, but stands in intimate relationship with the nature of these hypertrophies. It shows no tendency to spontaneous retrogression.

By some authors these corpuscles have been regarded as blastomycetes, but this view does not seem at the present time tenable.

Atrophy of Lymphoid Tissue. With advancing age the pharyngeal and faucial tonsils exhibit normally retrograde changes. Inasmuch as the phenomena characterizing these processes are essentially identical in the two situations, the consideration will be limited here to those occurring in the faucial tonsils, which have been more fully studied. The retrograde metamorphosis begins in the regions where the connective tissue originally predominated, namely, in the trabeculæ and the submucous connective tissue. It may progress along the trabeculæ in the form of an irregularly sclerotic process, or in a more homogeneous and symmetrical manner, extending from the base of the organ toward the mucous membrane of its free periphery. In the sclerosed areas the endothelial cells of the reticulum exhibit less evidence of proliferation and become fewer in number. Later those forming the germ-centre of the follicle entirely disappear, and there is left to represent the follicle merely a heap of lymphoid cells, which progressively decrease in number until finally the former site of the follicle is occupied wholly by connective tissue in which fat may be deposited. The follicles most remote from the crypts experience the greatest amount of atrophy, while those nearest the crypts, and those particularly nearest the orifice of the latter preserve correspondingly best their functional activity.

CHAPTER XVII.

METHODS OF EXAMINATION; INSTRUMENTS AND APPARATUS AND THEIR USE.

By J. E. NEWCOMB, M.D.

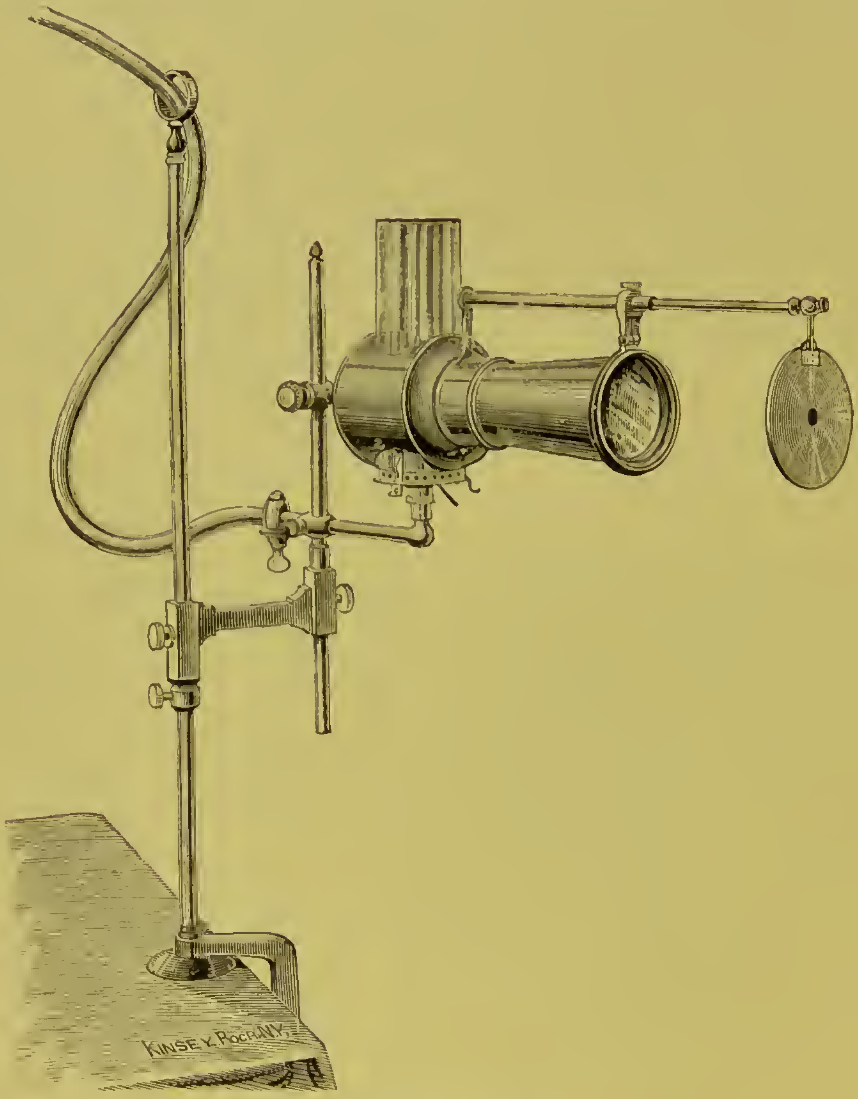
The requisites for a proper examination of the upper air passages are a suitable source of light, adequate reflectors, correct attitude of patient and examiner, and approved instruments. Students should be encouraged to follow a uniform method of examination in every case, so that no point shall be overlooked, and every effort should be made by those giving instruction in these branches to inculcate careful habits of observation and to develop the faculty of definitely recording the findings in each case.

Anterior Rhinoscopy. Source of Light. The ideal source of light is the sun, for thereby are the anatomical structures seen in their true color, a matter very difficult to attain by artificial light, which has its own color, dependent on the source. As sunlight cannot be relied upon, however, artificial illumination is employed. The simplest method is that of the ordinary candle flame, but it is too feeble and flickering, except for emergencies. At the bedside an excellent view may be obtained if the candle flame is backed by the bowl of a polished tablespoon which serves as an improvised reflector. Here the light is thrown directly upon the part to be observed. In cities the Welsbach-Argand gas-burner has come into almost universal use. It gives a clear but white light. Electricity may be used, and is coming into more general employment. If used, the glass bulb containing the incandescent filament must be frosted or ground, otherwise there will appear in the reflecting mirror an image of the filament, obscuring the clearness of vision. No matter what source of light is employed, all apparatus should be so arranged that it can be raised and lowered and swung from side to side. The general arrangement of the light can be appreciated by reference to Fig. 363. In order to concentrate the light some form of condenser is employed. Where electricity is unavailable perhaps the most satisfactory arrangement is the Welsbach-Argand gas-burner placed either on a swinging bracket or attached to the frame of a student lamp.

Reflectors are either worn on the forehead or are attached directly to the illuminating apparatus, as illustrated in Fig. 363. The majority of physicians wear the mirror on the forehead.

There are several varieties of head-bands, but the one advised is that known as the Pomeroy (Fig. 364), which has an arm to which the mirror is attached by a universal joint, permitting of rapid and easy manipulation. The mirror should have a diameter of from three to four inches and a focal distance of about fourteen inches. The head-band may be made either of light webbing or heavy corded ribbon, materials which are preferable to elastic. The mirror is placed over the eye corresponding to the side from which the light comes, and binocular vision is easily secured by looking through the central perforation. Head-bands with a frame-piece resting on the bridge of the nose are to be avoided. So also are spectacle-frames to which the mirror is attached. In warm weather the use of the spring head-band is more comfortable. This may be used to carry the ordinary mirror, or may have attached cords terminating in an electric lamp. Such

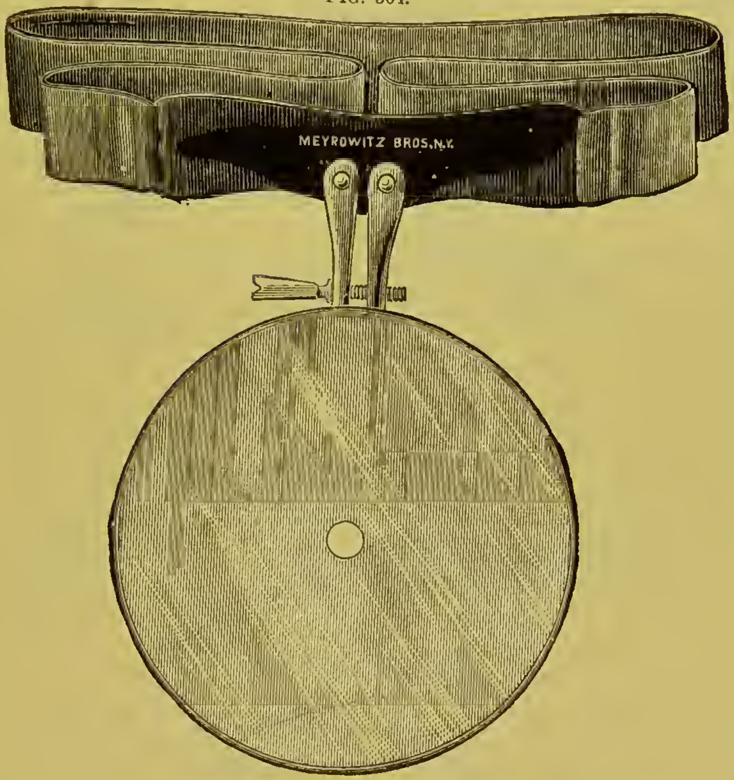
FIG. 363.


KINSEY. ROCH.N.Y.

Light and condenser.

an apparatus (Fig. 366) is known as a "photophore," the model devised by Phillips being in most frequent use.

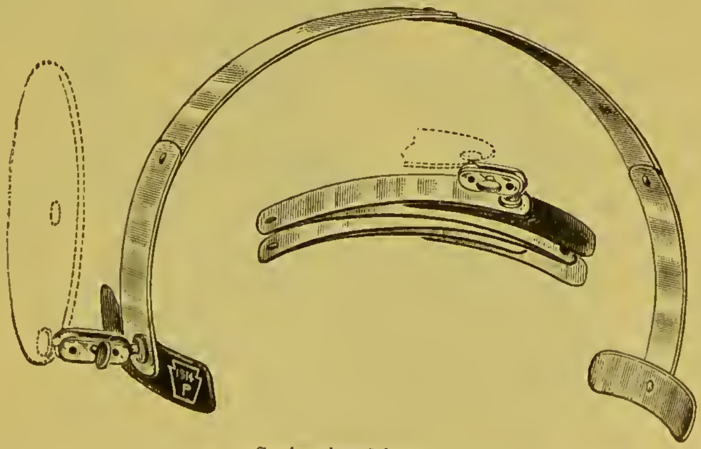
FIG. 364.



The Pomeroy head-band and mirror.

The relative attitudes of physician and patient are seen by reference to Fig. 367. A satisfactory arrangement so far as seats are concerned is to have the patient sit on a stool which can be raised or lowered, while the physician sits on a revolving stool of fixed height. Behind the patient should be a rest for the head and shoulders which can

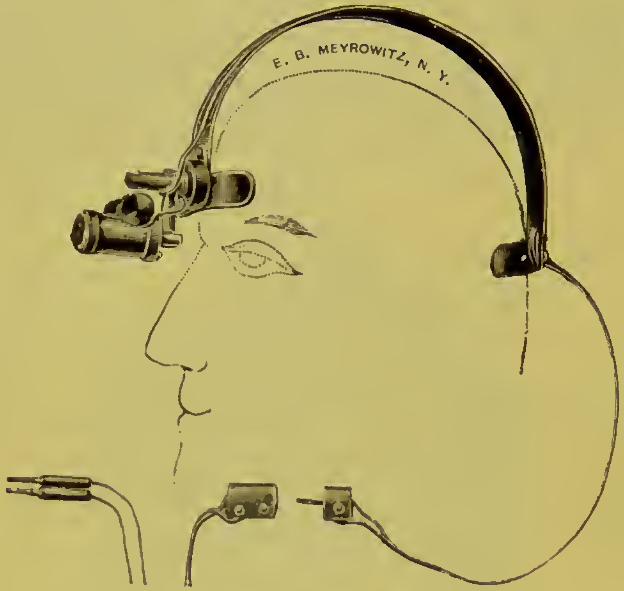
FIG. 365.



Spring head-band.

be raised and lowered at will. The object is not only to fix the upper part of the body, but also to prevent the patient (in case he should make an incautious movement) from doing himself harm.

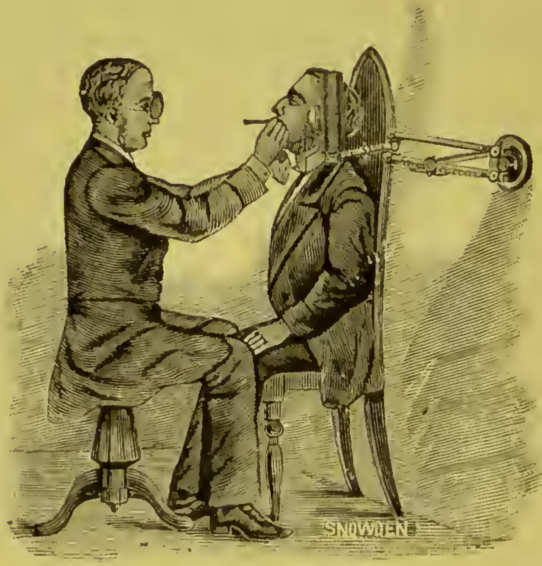
FIG. 366.



Phillips' photophore.

The instruments required for anterior rhinoscopy are some form of nasal speculum, a cotton-tipped applicator, and a flexible probe, one of aluminum being preferred. The first dilates the parts to be examined, the second can be used for the removal of any secretion,

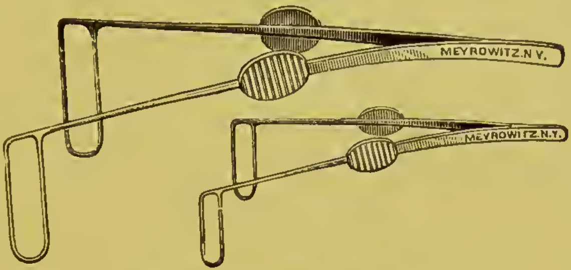
FIG. 367.



Attitude of physician and patient.

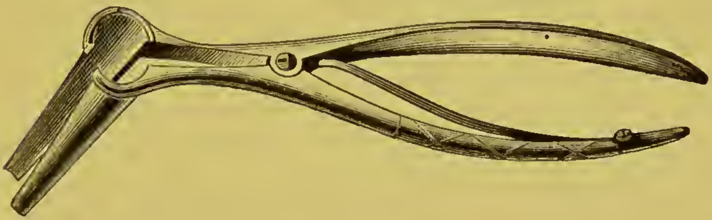
while the third enables us to explore the deeper recesses of the nares, and by contact to determine the density of the tissues. In the hands of the practised observer it becomes practically a prolongation of his finger. Of nasal specula there are many varieties, some of which are here shown. (Figs. 368-373.)

FIG. 368.



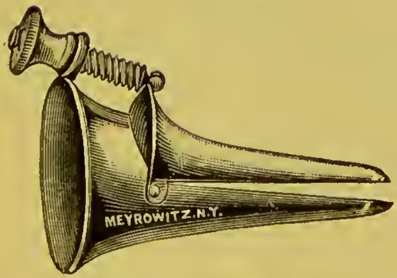
Bosworth's nasal speculum.

FIG. 369.



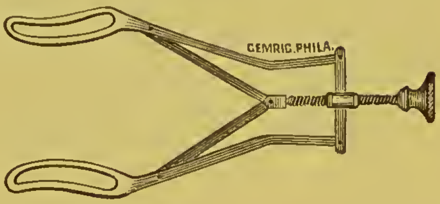
Hartman's nasal speculum.

FIG. 370.



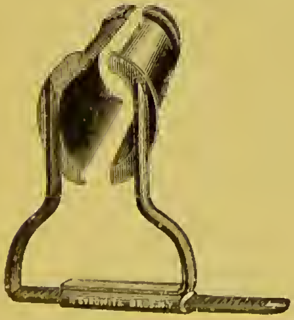
Duplay's nasal speculum.

FIG. 371.



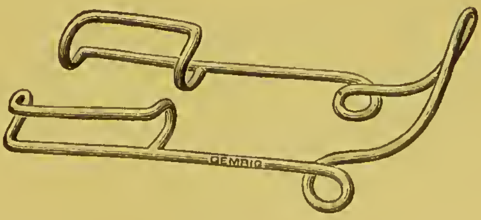
Fränkel's speculum.

FIG. 372.



Myles' nasal speculum.

FIG. 373.



Gleason's nasal speculum.

The so-called self-retaining specula are not of such great service as their name would seem to indicate, for the force of the spring against the nasal alæ necessary to hold the latter open is often painful to the patient; moreover they often slip out during an operation, much to the surgeon's discomfiture. Gleason claims to have overcome these objections by the instrument which bears his name. (Fig. 373.) He states that it is impossible to shake the instrument out of the nose, no matter how violent the patient's struggles. It may be attached to a head-band, so that the tip of the nose is elevated, exposing the cavities for operation, thus leaving both the surgeon's hands free. With any instrument the examiner should be careful to exclude his hand from the line of vision.

The patient having been seated as indicated, the light should be so placed as to come from a point a little behind the plane of the patient's face and at the vertical level of the top of his ear. The head-mirror is then adjusted so as to focus the light upon the nose. The organ should be carefully examined as to its contour and symmetry and the existence of lesions in either the skin or subcutaneous tissue. Certain skin erythemata may be due to intranasal conditions causing pressure. The condition of the alæ should be noted, whether they are freely open or collapsed, and whether, as sometimes happens, they are contracted during inspiration. The instruments are to be kept in a bowl of weak carbolic solution on a table at the side of the examiner, and after each usage should be dipped for a moment in boiling water. Too great stress cannot be laid on this matter of the care of instruments. The first and middle fingers of the left hand should rest on the bridge of the nose, while its tip is elevated by the thumb. The blades of the speculum, warmed and dried, are now inserted in the nostril as far as the nasal bones, but not beyond. Obviously only the cartilaginous portion is dilatable. The alæ having been gently opened, we first determine the position and state of the septum, noting any deviations as a whole, any local thickening, spurs, or ridges, etc., and then the condition of the mucosa, whether covered with the natural moisture, thick tenacious mucus, crusts, or erosions. The nature of doubtful areas will be determined by the use of the cotton-carrier, which will remove secretions unless unusually adherent. The probe will determine the consistence of any redundancy of tissue. The condition of the turbinated bones should next be ascertained, whether of normal size and shape, whether hypertrophied or atrophied, whether in contact with the septum, causing intranasal pressure, and whether the fleshy masses sometimes seen are polyps or merely polypoid degenerations of the mucosa. The probe should be passed between the bone and the septum if possible, to determine the patency between these structures. It will also determine the presence and often the nature of foreign bodies. Variations in the position of the patient's head will enable all portions of the nares to be brought into view. Thus it should be depressed in order to bring under inspection the nasal floor which, it will be remembered, gradually rises from the nasal entrance, passes over a rounded eminence, and then slopes more gradually backward. Correspondingly, in order to inspect the nasal roof, the head should be tipped somewhat backward. Under ordinary circumstances the superior turbinated bone is not seen in the anterior view. It is sometimes visible in conditions of marked atrophy, as is also the posterior pharyngeal wall. If the patient is made to pronounce the letter "k" in rapid succession we can sometimes determine the play of the tendon of the tensor palati muscle as it plays around the hamular process of the internal pterygoid plate of the sphenoid bone. Another method sometimes of value is to open both nares, illuminate one with the light, and then look into the other. If the tissues are inflamed we may first spray with a weak cocaine solution or with one of adrenalin, and then wait a few minutes before proceeding with the examination. The shrinkage of tissue which will take place from these agents will often clear up obscure points and bring into view lesions previously hidden.

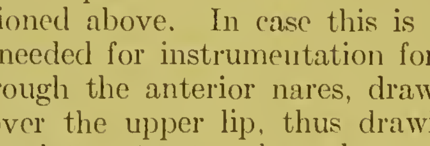
Posterior Rhinoscopy. This requires the use of the tongue depressor in the manner mentioned below, and of the small post-nasal mirror. Sometimes the patient will have sufficient control over the tongue to place it in the proper position, but this is rarely the case. Mirrors have been devised whereby the angle of attachment of glass to handle can be varied at will, but this is not necessary. The glass should first be cleansed, then warmed for a few seconds over the gas flame or some source of heat until the slight film which immediately forms over its surface has disappeared. If no source of heat is at hand, the glass may be rubbed with a bit of soap and then rubbed off with the finger. Enough of soapy film is left to prevent the condensation of the breath on the glass. Still again it has been suggested by Baurowicz to substitute for the soap a one-half per cent. solution of cold lysol. The mirror is dipped in the solution and then shaken dry. Enough of the lysol film will adhere to the glass to prevent condensation of the breath, but the view is still perfect. Lysol being a valuable disinfectant, may replace the carbolic solution in the bowl on the examiner's table. Its odor, however, is somewhat disagreeable. Finally, the temperature of the mirror should always be tested, as by contact with the skin of the back of the hand.

The foregoing manœuvres having been executed, the mirror is carefully passed between the uvula and right faucial pillar, and then turned so as to bring its face upward. It is a good plan, for beginners at least, to poise the third finger of the right hand at the left corner of the patient's mouth; the position of the mirror can then be varied at will by rotation of the handle between the thumb and finger of the hand, so as to bring successively into view the various portions of the nasopharynx. While as large a mirror should be used for this purpose as space will permit, no one view includes the entire area to be examined, so by the rotation of the mirror a composite view of the entire region can be built up in the examiner's mind.

Attention should first be fixed upon the posterior edge of the septum in the median line. No matter how much deviation from the normal there may be anteriorly, it is very rare to find the posterior septum other than straight in its median line, although there may be localized thickenings on either side. These thickenings are generally œdematous in nature, and quickly disappear under cocaine. Next to be determined is the condition of the posterior extremities of the turbinates. As compared in color with the anterior they are apt to be of a more grayish hue, more vascular, and often are lobulated in appearance. The patency of the choanæ should be looked into, and as well the condition of the pharyngeal tonsil, whether enlarged or not, and whether there is any persistence of the original median cleft. The edges of the latter are sometimes adherent, forming a mass known as the "pharyngeal bursa." Complete adherence gives the condition known as cyst of the bursa or Tornwaldt's disease. Lateral rotation of the mirror will bring into view on each side the fossæ of Rosenmüller and the Eustachian cushions.

The foregoing manœuvre is perhaps the most difficult of all in the examination of the upper air passages. The least gagging of the patient raises the soft palate, and so shuts off the view. To prevent this we may order a bromide gargle and may give the remedy internally, an ice-water gargle, or may apply a weak cocaine solution. In some obstinate cases, and generally in young children, a digital examination is necessary. For this purpose the head of the patient should be encircled with the left arm, and as he opens his mouth the finger thrusts his cheek in between his molar teeth, thus preventing him from biting. The index finger of the right hand is then passed rapidly behind the soft palate and the various structures palpated in the order mentioned above. In case this is not satisfactory, or if a wide space is needed for instrumentation for any reason, cords may be passed through the anterior nares, drawn out through the mouth, and tied over the upper lip, thus drawing the soft palate forward. Various palate retractors have been devised, the one in common use being known as White's. (Fig. 374.)

FIG. 374.



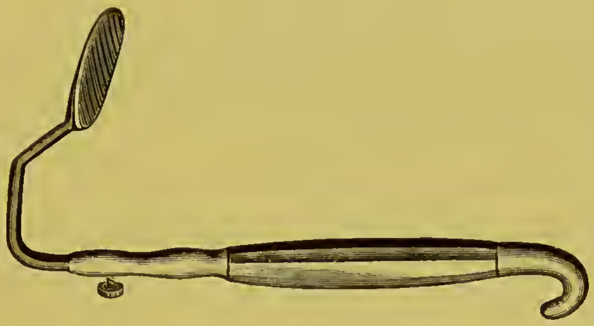
White's palate retractor.

While such instruments are occasionally of service, they are not well borne by the majority of patients. When well borne their use is generally unnecessary.

Transillumination as used for the detection of sinus disease is described in another chapter.

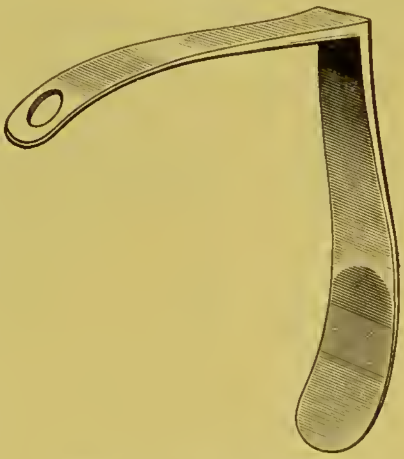
Pharyngoscopy. The positions of examiner and patient are as already described. The lips should be everted and search made for eruptions, excoriations, and for the general condition of the teeth. Of tongue depressors there is an infinite variety. The model known as Türck's is perhaps the most useful. Several sizes, all metal, should be at hand. For children the model devised by H. D. Chapin has proven of much use to the writer. It can be used in the youngest infant. The utmost care should be exercised in keeping all tongue depressors surgically clean, and they should be sterilized in boiling water each time they are used. Corrugated surfaces should be avoided in their construction, as they are harder to keep clean and offer no advantage. The patient having opened the mouth, the depressor is placed on the tongue and gentle pressure made directly downward. Force employed either to draw the tongue forward or to push it backward will surely excite gagging. The parts having been thus exposed, we note the condition of the mucosa lining the oral cavity, the tonsils, whether enlarged or not, the condition of the lacunæ, whether or not the faucial pillars are adherent, the condition of the uvula, soft palate, and pharyngeal wall, whether normal or inflamed and presenting ulcerations, etc. As in the nose, the use of the cotton-carrier and the probe will elicit valuable information. The latter also enables us to determine the condition of innervation of the soft palate. Particular attention should be paid to the color of the pharyngeal mucosa. An anæmic appearance is suggestive of tuberculosis; patchy symmetrical redness may suggest syphilis, especially if accompanied by pain without apparent cause; the throats of users of alcohol in excess are apt to be raw, congested, and intensely irritable, while tobacco habitués present throats with a dry, glazed

FIG. 375.



Türck's tongue depressor.

FIG. 376.

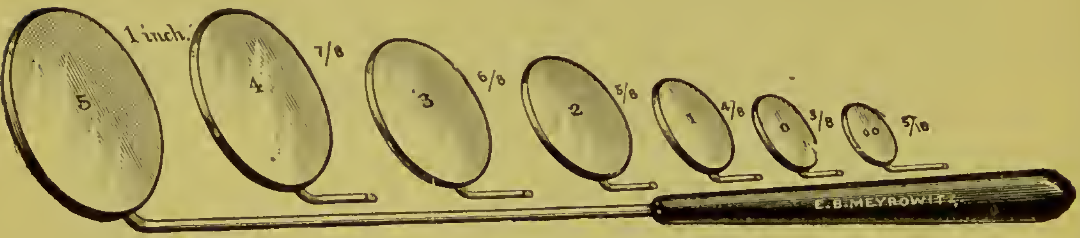


Chapin's tongue depressor.

surface. The irritability may be referred partly to the gastric condition which always accompanies to a greater or less extent these two conditions.

The examination of the tongue is not complete without the use of the large mirror used in laryngoscopy (see below), but here it need not be passed so far back. A most careful exploration must be made of that portion of the tongue occupied by the fourth or lingual tonsil, namely, the area between the circumvallate papillæ and the epiglottis. Two conditions should be looked for, first, a possible enlargement of the tonsil itself, which may present either as a central mass or as bilateral masses separated by a deep furrow, or still again as smaller masses scattered irregularly over the area; second, enlarged veins forming the so-called lingual varix or hemorrhoids of the tongue. These two conditions are often responsible for much pharyngeal dysæsthesia and obstinate cough. So, also, the glosso-epiglottic fossæ are often the receptacles of foreign bodies. In examining the pharynx for the latter, palpation should never be omitted, for the finger will often detect the sharp points of fishbones, etc., not visible to the eye. Various models of small electric lamps have been devised and can be passed directly into the mouth, thus giving a brilliant illumination of the entire cavity.

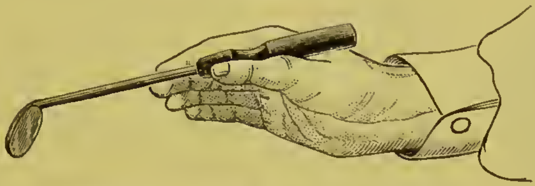
FIG. 377.



Laryngoscopic and rhinoscopic mirrors.

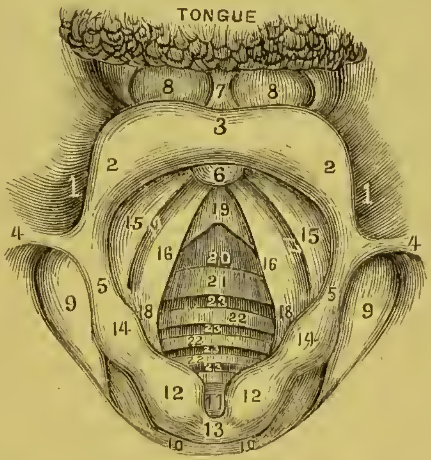
Laryngoscopy. This requires the use of the larger sizes of mirrors. (Fig. 377.) The position of examiner and patient remaining as before, the latter protrudes the tongue, which is grasped by the examiner with a towel, Japanese paper napkin, or a small square of gauze. The gauze is greatly to be preferred to towels, which may be the carriers of infection, whereas the gauze can be thrown away after use. The left forefinger of the examiner, guarded by the gauze, is laid along the level of the patient's lower teeth just above the incisors, and the tip of the tongue is held by the thumb without traction, for the object is not to draw it forward, but to simply prevent it from slipping backward. The foregoing preliminaries accomplished, the large mirror, held as shown in Fig. 378, invariably cleansed, warmed, and tested on the skin of the examiner's hand, is introduced either by a free-hand movement or with the third finger of the right hand resting on the left corner of the patient's mouth, and carried backward without touching the parts until the point of junction between the glass and handle rests at the base of the uvula. The latter is then lifted gently upward and backward until it is almost horizontal and the parts come into view, as seen in Fig. 379, which, however, is partly schematic and represents the position of the cords in deep inspiration. The various parts named should be carefully inspected for the possible presence of foreign bodies, ulcerations, and infiltrations, and the patient directed to take a series of short deep inspirations, so as to make the rhythmical excursions of the cords as pronounced as possible. In this way their mobility is the more easily determined. The respiratory state of the larynx having been thus inspected, the patient is directed to phonate some vowel, as "a" or "e" in high pitch. · This act depresses the base of the tongue and raises the soft palate. At the same time as the pitch is raised the whole laryngeal box rises. In this way the position of the cords in phonation is easily made out. (Fig. 380.)

FIG. 378.



Method of holding the laryngeal mirror.

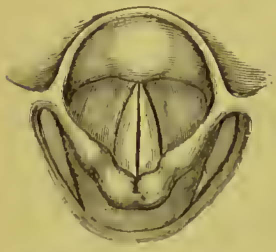
FIG. 379.



The larynx in deep inspiration. 1. Lingual surface of epiglottis. 2. Its laryngeal surface. 3. Its cushion. 4. Pharyngo-epiglottic fold. 5. Aryepiglottic fold. 6. Cushion of epiglottis. 7. Glosso-epiglottic ligament. 8. Glosso-epiglottic fossa. 9. Sinus pyriformis. 10. Posterior line of larynx adjoining œsophagus. 11. Interarytenoid space. 12. Arytenoid cartilages surmounted by cartilages of Santorini. 13. Interarytenoid fold. 14. Cartilages of Wrisberg. 15. Ventricular bands or false cords. 16. True cords. 17. Laryngeal ventricle. 18. Vocal process. 19. Thyroid cartilage. 20. Crico-thyroid membrane. 21. Cricoid cartilage. 22. Tracheal rings. 23. Spaces between tracheal rings. (COHEN.)

In the case of nervous patients it is best to introduce and withdraw the mirror several times before any attempt is made at actual inspection; so, also, some patients do better if they themselves are allowed to hold the tongue in the gauze napkin. By these devices their confidence is gained and they understand just what is desired. A point apt to confuse beginners is the fact that in the mirror the antero-posterior position of the parts is reversed, so that the arytenoid cartilages, for instance, seem to be toward the examiner. This fact must especially be borne in mind in all instrumentation within the larynx. In quiet respiration the movements of the cords are often not appreciable, especially to a beginner in laryngoscopy.

FIG. 380.



Phonation position of the vocal cords.

Two other methods of illuminating the interior of the larynx are sometimes used. In one, a small electric bulb is attached to the mirror handle in such a way as to project slightly in front of the glass. The latter is used as before, and the examination can be made with the physician and patient in any position comfortable for both; in the other the larynx is transilluminated by a powerful electric light placed externally over the cricoid cartilage, the laryngeal mirror being introduced as before. This method, however, shows little more than lights and shadows, and while it may detect the presence of infiltrations and new-growths, it has never come into general use. All the information it gives can be more accurately determined by other means. Still more recently the X-ray has been used in a similar manner to locate foreign bodies. For clinical purposes other than this it is not especially serviceable.

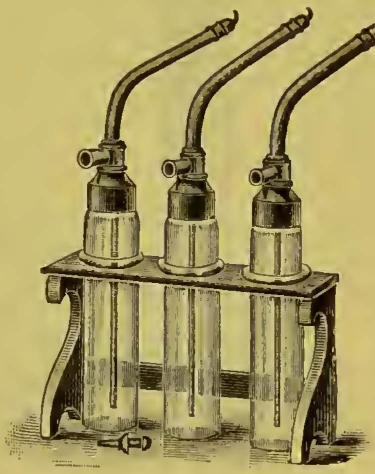
Some years ago Kirstein, of Berlin, revived what is probably the oldest method of inspecting the larynx, namely, that of direct vision. This he calls autoscopy; as has been suggested, orthoscopy is, from a mechanical point of view, the more correct term. In this method an endeavor is made to have the axis of the mouth continuous with that of the lower pharynx and trachea. This is effected by having the patient bend the upper part of the body forward, and at the same time throw the head slightly backward. No mirror is used, but rather a specially-shaped tongue depressor, to which may be attached an electric light. The examiner looks down upon the cords themselves and not upon an image of them. Kirstein claims that this method is applicable in about one-half of all patients, a statement which is not borne out by common experience. The method is without anæsthesia often painful and requires an unusually good control of the parts by the patients themselves. Foreign bodies have been removed with the autoscope in position and, we believe, some tumors, but the instruments require a special shape, and the method has never come into general use.

Still another method of practical value is that of Killian. Here the patient stands up or sits with the head bent forward, while the examiner kneels before him and holds the back of the mirror up against the uvula. This enables us to get a view not so much of the anterior part of the larynx, as by the usual method, but to see the posterior wall, the posterior ends of the cord, and occasionally slightly underneath their surface.

The foregoing manipulations have been spoken of as easy of performance. They generally are after a little practice, but occasionally a patient is seen in whom the configuration or irritability of the parts renders it impossible to see anything whatever until he has been subjected to a course of training. No force should ever be used, instruments should be warmed, every movement on the part of the examiner should be deliberate, and everything be done to secure the patient's confidence. On the least appearance of retching the mirror should be withdrawn and not reinserted until the patient has had full time to recover himself. Persistent gentleness will finally overcome all obstacles and enable one to secure an intelligent view of the laryngeal structures.

Douches and Sprays. In nearly all cases of nasal disease some method of cleansing is necessary, and as this constitutes the major part of home treatment it deserves detailed consideration. Medicinal agents are applied to the nasal fossæ by means of sprays, douches, etc., or topically by means of the cotton carrier, powder blowers, or inhalers.

Fig. 381.

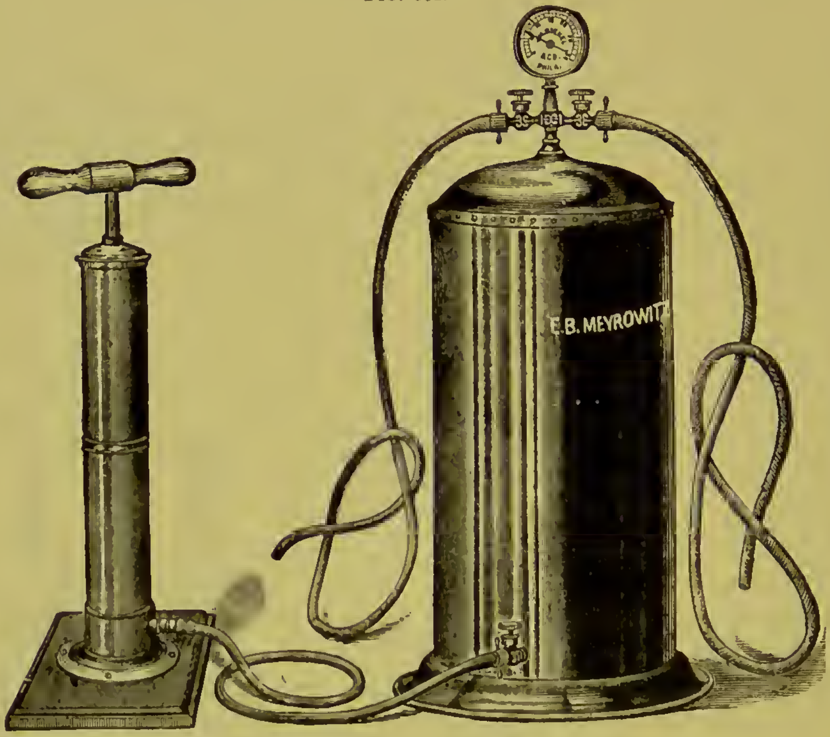


Nasal spray tubes.

For purposes of spraying we have at our command the familiar spray tubes for office use, which may be supplied with air from a reservoir filled either by hand power, hydraulic motor, or electricity. For home use the Bosworth atomizer answers every need. Many of the various atomizers on the market are objectionable in that they throw too fine a spray. The ordinary toilet atomizer is entirely useless for the treatment of catarrhal states. If the menstruum for the medicinal agent is an oil or vaseline, a special form of atomizer is required, and we have found the one herewith shown (Fig. 384) to answer every purpose. In case vaseline is used the whole bottle can be immersed in hot water for a minute or two until the contents are liquefied.

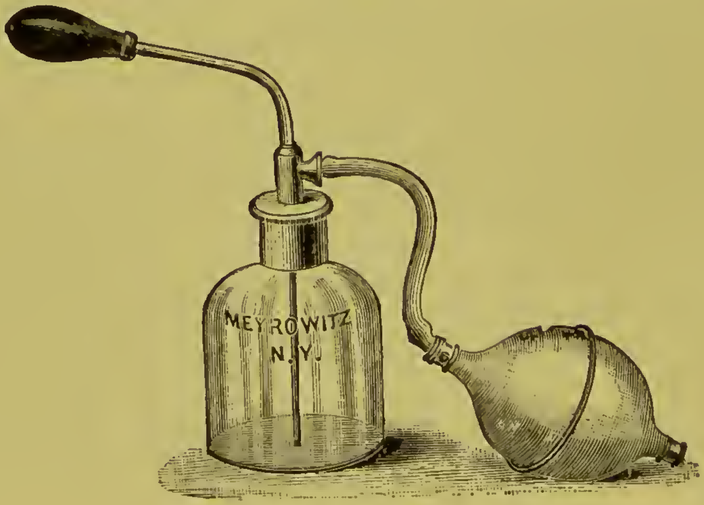
Of preparations made with water as a base there is an infinite variety. At the outset it may be said that the faithful and systematic use of any one of a very large number that might be mentioned will afford better results than the desultory employment of some fanciful and new formula. In many cases a sterilized normal salt solution answers every requirement. The addition of an alkali is often advisable, and we may order the familiar combination of equal parts of common salt, bicarbonate and borate of soda, one teaspoonful to a pint of lukewarm water. The object is to prepare a solution which shall have the saline strength and temperature of the normal blood plasma. There is thus no osmosis through the nasal mucosa from

FIG. 382.



Air pump and reservoir.

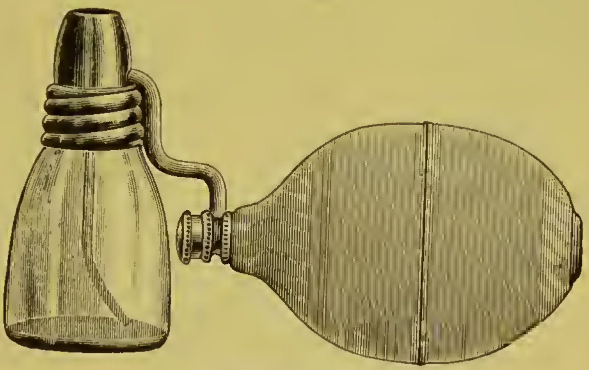
FIG. 383.



Nasal atomizer.

saline solutions of different densities, and no harm to delicate structures from a sudden change in temperature. Ten grains of the salicylate of soda may be added to each teaspoonful of the above mixture. When distinct antiseptics are needed there is a wide variety to choose from. Listerine and the familiar Seiler tablet are perhaps the most widely known. Borolyptol has given the writer much satisfaction. It may be used in the strength of 1 to 500. Of all these preparations one or two teaspoonfuls can be used in a glass of lukewarm water. Many more might be mentioned, but while the writer has no objection against recommending preparations made by manufacturing chemists who confine their sales to physicians and druggists, it is important to bear in mind the limitations of this class of remedies. To say that they cure catarrh, as is alleged by some of their promoters, is not true. They cleanse the nasal passages; if alkaline, they will have a detergent effect and so slightly reduce redundant tissue, but they are not strictly curative. for other procedures are often necessary. They have an antiseptic action, although from the fact that the nares are constantly flushed with bacteria-laden air, it is not possible to maintain an aseptic condition. With the foregoing preparations all the problems of intranasal medication, so far as concerns aqueous solutions, can easily be met.

Fig. 384.

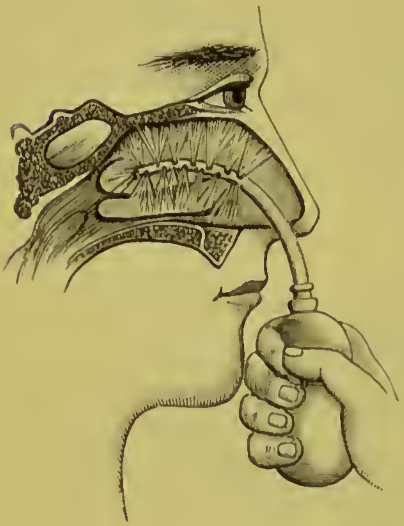


Vaseline atomizer.

Many persons who suffer with hypertrophic rhinitis are fairly comfortable so long as they make the nasal toilet once or twice daily. They become accustomed to this procedure and do not mind it. In many such cases no surgical intervention is at all necessary. The foregoing statements seem to be a fair exposition of what aqueous solutions do in the nose. The indefinite claims of many chemists that such solutions will cure catarrh by stimulating the mucous membranes is absurd. Most noses, at least in northern climates, are overstimulated already.

In recent years various oily menstrua have become very popular. They may often be used with great advantage after the nares are cleansed by watery solutions. They mechanically coat over and protect the delicate tissues, and may also be the carriers of various medicinal agents. Of these oils alboline, benzoinol, and eucalyptol may be named as types. They may be used either pure, or contain in solution or mixture such remedies as menthol, pine-needle oil, resorcin, camphor, etc. Every physician has his favorite combination; but here again it is to be noted that the faithful and systematic use of any one properly indicated will give more satisfactory results than the desultory employment of the latest pharmaceutical fad. Of course, the general truth is applicable here as elsewhere, that a remedy may after a time lose its effect and may properly be replaced by another, even of the same class, but the general caution given is justified.

Fig. 385.



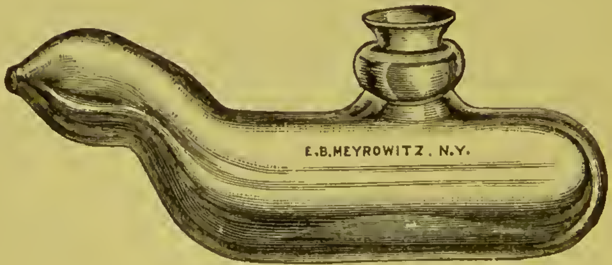
Intranasal catheter-syringe.

It should be added that there is a limit to the advantages of oily preparations, for if continued too long they are apt to cause a dryness of the nasal mucosa. Each case must be considered by itself and watched to prevent the occurrence of this result.

Several other methods of cleansing the nasal fossæ are yet to be mentioned. A very useful device is that shown in Fig. 385, in which a soft rubber catheter with a number of perforations along its sides is attached to the common rubber hand-bulb. It is filled by suction, and the mode of use is at once appreciated by reference to the figure.

Again, the nares may be cleansed by the nasal douche operated on the principle of the ordinary fountain syringe. This method has the disadvantage of being liable to injure the Eustachian tube and of causing possible middle-ear trouble. Many patients, however, can use it with safety. During its employment the mouth should be held open, the soft palate raised, and all attempts at swallowing, speaking, etc., carefully avoided. No patient should be allowed to inaugurate the process himself without a previous demonstration by the physician either on himself or on the patient. Many physi-

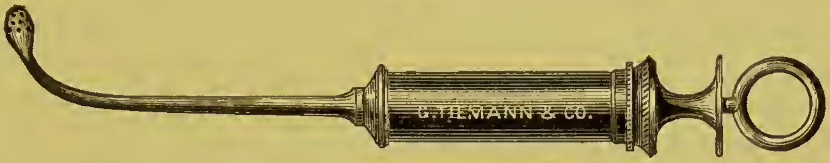
Fig. 386.


E.B.MEYROWITZ . N.Y.

Nasal douche cup.

cians condemn the method entirely for the reason above stated. An efficient substitute is the nasal douche cup. Many of those sold in the market are entirely too small. The cup should have a capacity of at least 50 c.c. The same precautions should be observed as with the douche. The bulk of fluid used in flushing the nose in this manner seems to be more efficient than the fine sprays.

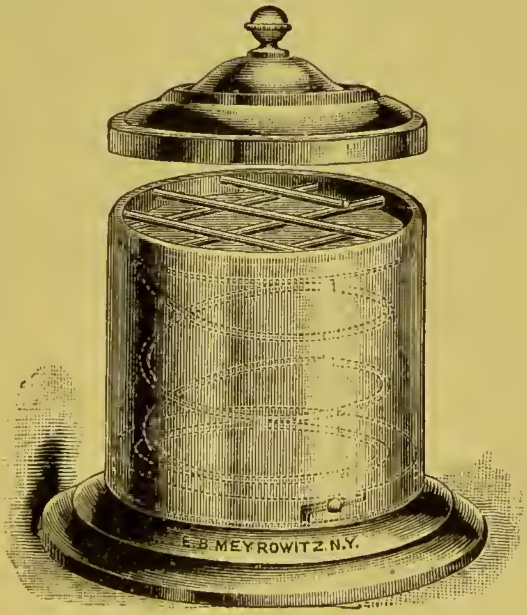
FIG. 387.



Hard-rubber postnasal syringe.

For cleansing the nares from behind we may use either an atomizer with a long curved tip, which the patient learns to pass behind the soft palate, or the hard-rubber postnasal syringe. (Fig. 387.) The latter is a most useful instrument for office use. It should be carefully introduced between the uvula and the faucial pillar, care being taken not to injure the soft palate if the patient makes an incautious movement. It so divides the stream of fluid by means of the perforations in its tip that the delicate Eustachian cushions are not injured, and yet the volume of fluid is amply sufficient to thoroughly cleanse the entire postnasal space. After using any nasal cleansing fluid the patient should blow the nose gently, always having one naris freely open.

FIG. 388.

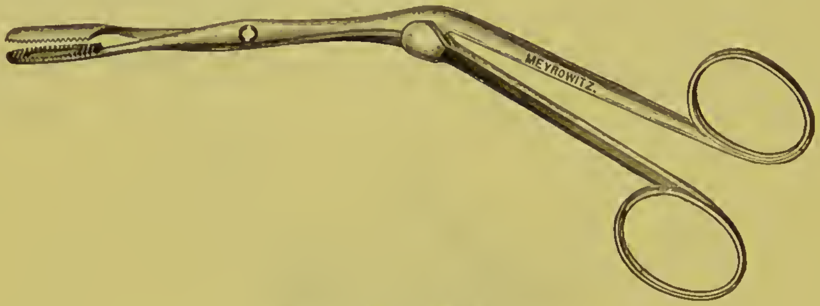


Phillips' cotton holder.

The application of pigments is generally made with a cotton-carrier. A piece of copper wire roughened at the end and inserted in a mirror-handle answers every purpose. Cotton should be kept in a receptacle such as is shown herewith. (Fig. 388.) The nose is first cleansed and then dried. The medicinal agent can be applied to any special portion of tissue as desired. The preparations most commonly used are stimulating agents for atrophic conditions—*e. g.*, ichthyol for atrophic rhinitis, varied in strength according to the degree of atrophy, beginning with 10 per cent. ichthyol in glycerin or alteratives in hypertrophic conditions. A valuable combination for the latter purpose consists of iodine gr. v, potass. iodid. gr. x, in half an ounce of glycerin. This is used in increasing strengths as the case progresses toward recovery. Another combination is made of cocaine gr. xl, balsam of Peru ʒss, oil of peppermint and alcohol āā ʒvj.

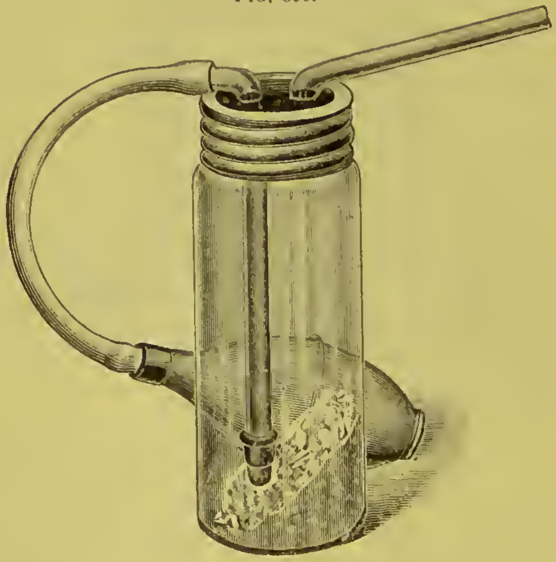
If the means used for cleansing the nares prove inefficient for the removal of thick crusts, we may employ various kinds of forceps. Knight's dressing forceps are sufficient for this purpose. (Fig. 389.)

Fig. 389.



Knight's nasal dressing forceps.

Fig. 390.



Nasal insufflator.

For the application of powders the insufflator shown (Fig. 390) will suffice. It is simple in construction, easy to keep clean, and answers just as well as the more elaborate powder blowers.

Finally, we may affect the nasal mucosa by having the patient inhale various remedies, but for this purpose no special apparatus is required. The medicinal agent may be dropped on cotton placed in an ordinary smelling salts bottle. This latter is as good as the more elaborate inhalers.

Cocaine and Suprarenal Extract. The remedy generally employed for local anæsthesia in the nose is cocaine muriate. It is recommended that the remedy be kept in the physician's office in powders of definite strength, so that one dissolved in a drachm of sterile water will make a 10 per cent. solution which can be diluted as desired. For the ordinary intranasal operations 10 or even 20 per cent. may be used. There is doubt as to the necessity of such strengths. Some time may be gained by their use, as naturally the stronger the solution the more of the drug absorbed in a given time; but for such procedures as the use of the cautery, saw, cutting forceps, snare, etc., a 5 per cent. solution is strong enough, especially if there be added thereto 2 per cent. of sodium sulphate. The latter remedy favors absorption. It is a good plan to spray the nostril first with a 2 per cent. solution, and then apply the 5 per cent. on cotton, which should remain in contact with the field of operation for at least ten minutes. If the spray be used care should be taken that the amount of drug used does not exceed a safe internal dose, and for that reason the atomizer or spray tube should be graduated. The cotton pledget should be squeezed sufficiently to prevent dripping, and after its application the patient should incline the head slightly forward, so that there can be no possible trickling of the overflow into the nasopharynx. If this occurs pharyngeal reflexes are set up and it is difficult to control the patient. Idiosyncrasy to cocaine is one of the things that cannot be foreseen, and the physician should always handle this powerful remedy with circumspection.

Where constitutional symptoms occur we most commonly note a feeling of constriction about the throat and possibly the chest, with pale face, dilated pupils, and rapid pulse. If these symptoms supervene, all further attempts at operation must for the time be discontinued. The patient's clothing should be loosened about the neck and chest, he should lie with head low, and a simple stimulant given —*e. g.*, aromatic spirits of ammonia. In severe cases strong coffee, caffeine, or spirits may be needed. The utmost caution should be exercised in placing solutions of the remedy in the patient's own hands. If it is ever necessary it is advisable to keep him in ignorance of the nature of what is ordered. The freedom with which cocaine is sold by druggists, the familiarity of the laity with it, and the numerous cases of the cocaine habit which in recent years have been reported as following its use in the nose, all render these cautions more than perfunctory. We know of no fatal cases from the effect of a single intranasal application, but there have been several narrow escapes.

In view of attendant risks, an effort has been made to find a substitute for cocaine possessing equal anæsthetic power, but devoid of danger. Various modifications of cocaine itself have been suggested, notably phenate of cocaine, which is highly commended by various clinicians. It needs to be given in slightly stronger strength than does the cocaine itself. Tropococaine, an alkaloid obtained from Java cocaine, is another substitute, but has never come into general use. Eucaine ("A" and "B") has been quite extensively employed in a 6 per cent. solution in the same general way as cocaine. Holocaine is another remedy of this class. The three latter are undoubtedly less generally efficient than cocaine, but according to universal experience are freer from toxic effects.

Quite another class of remedies for the purpose of anæsthesia is represented by guaiacol. Its effects, however, are more or less uncertain. It may be dissolved in alcohol or preferably in olive oil, as the latter menstruum is less irritating. Guaiacol does not mix readily with olive oil, even the purest. The latter must first be cleared of its albuminoids, resinoids, and coloring matters by zinc sulphate, and of its fatty acids by absolute alcohol. The following mode of preparation has been found by experience to be a suitable one: To a given weight of oil 10 per cent. of dried zinc sulphate (by weight) is added and the mixture heated over a water-bath for one hour. It is then filtered, and then 12.5 per cent. (by weight) of absolute alcohol is added. The mixture is frequently shaken for a few days and then decanted. The result is a clear limpid fluid with which guaiacol, say 5 per cent., mixes readily. The anæsthetic action of guaiacol is much slower than that of cocaine, as we must wait some fifteen minutes for absorption to occur. It has no advantage over cocaine, but is often a reliable substitute if for any reason the cocaine is inadmissible.

It may be noted here that the effect of cocaine is greatly prolonged by the subsequent application of a 4 per cent. watery solution of antipyrine. The latter is also an excellent hæmostatic, but has no direct anæsthetic effect.

A. A. Gray has recently suggested the following modification in the use of cocaine. He employs two solutions. Solution A consists of cocaine hydrochlorate, 20 per cent. in rectified spirit; solution B of from 15 to 20 per cent. of eucaine "B" in aniline oil. Some of the eucaine does not entirely dissolve in this strength, and the bottle should be well shaken whenever used. Ten minims from each solution are mixed, the fluid speedily becoming clear. Gray admits that this combination is somewhat burning in the nose and throat, but claims that this disadvantage is more than compensated for by the deeper anæsthesia obtained, and especially by the absence of symptoms of cocaine intoxication. He advises its application on a strip of gauze rather than on cotton. The quantity mentioned is quite sufficient for the painless removal of septal spurs, cauterization, etc., and even for the painless excision of tonsils. In applying the remedy the effect appears to be greatly enhanced if it is gently rubbed for a few seconds over the field of operation. One disadvantage noted in one or two instances has been the effect of the aniline oil, which is a powerful compound and has caused a peculiar blueness of the lips, supposedly due to the conversion of oxyhæmoglobin of the blood into methæmoglobin.

Suprarenal Extract. Quite as valuable in its own field as cocaine for anæsthesia is the suprarenal extract, which has such marked hæmostatic properties. It acts on the unstriped muscular fibre of the vessel walls, whereas cocaine produces its constringing effects through the medium of the vasomotor nerves. At first the dried saccharated gland was employed in powder. A certain quantity, say twenty grains, may be added to a drachm of sterile water and the resulting mixture employed on cotton pledgets. A more satisfactory method is to allow the mixture to stand for twenty-four hours, with frequent shaking, and then to filter. The result is a fluid of a port-wine color with an odor like that of pepsin. All the foregoing trouble has now been obviated by the isolation of the active principle known as adrenalin, which in watery solution makes a colorless liquid, and is sold in the strength of 1 to 1000. This may be diluted for clinical use to even 1 to 5000. It possesses all the hæmostatic properties of the crude extract, and is much more agreeable to handle. Moreover, it can be sterilized at each use without impairment of its hæmostatic properties. If then we prepare our operative field by cleansing, drying, cocaine application for ten minutes, and adrenalin application for five minutes more, we have an anæsthetic, bloodless area, or ideal conditions under which to operate quickly, safely, and agreeably. Cocaine and adrenalin can also be combined in the same solution.

In the use of this class of remedial agents it must never be forgotten that reaction always follows the immediate effect and that there is always subsequent relaxation of the vessels, with possible hemorrhage. Consequently the post-operative tamponment should never be neglected. Following the general law that action and reaction are equal, though opposite, it might be supposed that vascular relaxation after adrenalin would be dangerously severe. On this point clinical opinions are at variance. Personally, we have never had reason to temper our first enthusiasm over the immense value of this agent in rhinological practice.

Adrenalin taken internally raises the blood pressure to a notable degree. It would seem the remedy par excellence for conditions of intumescent rhinitis, such as occurs in hay fever and other allied clinical states. That it has a most admirable effect here cannot be doubted. It acts promptly, does not seem to lose its power by frequent repetition, and causes no systemic disturbance. The claim is made that its internal administration is beneficial in hay fever. On the contrary, it is asserted by some eminent physiologists that it is decomposed in stomach absorption, and that it cannot possibly exert through this roundabout channel any local effect on the nasal mucosa. On such a point as this we need further testimony. Occasionally its reaction is so severe as to cause an actual œdema of the mucosa.

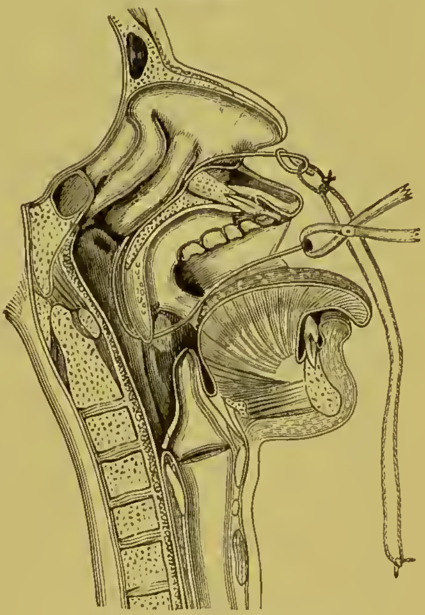
Epistaxis. Excluding the cases due to accidental or surgical trauma, the most frequent source of nasal hemorrhage is the septum. Its anterior mucosa is relatively thin, and bearing, as it does, the impact of the various irritants from the inspired air, it easily becomes eroded. The liability of this accident is increased if a spur exists at this point. A crust is formed by the mixture of dust and mucus, and this is carelessly removed by the patient, who takes off some of the epithelial covering of the mucosa, generally by the common habit of "picking the nose." The moist surface thus left attracts other dust, new crusts form and are removed, and finally we have a true erosion. Hemorrhage at this site is favored also by the distribution of the septal artery, which is a branch of the upper coronary from the facial. The erosion grows deeper and deeper, and may finally perforate the septum. After this happens the edges of the opening generally heal and the liability to bleeding disappears. Blood effused in one nostril may run backward around the posterior edge of the septum and escape anteriorly from the other side.

Most nose-bleeds cease of their own accord. The familiar cold effusion to the back of the neck acts through the medium of the vasomotor nerves, and checks some of the milder cases. In those coming under the attention of the physician the first thing to do is obviously to locate the bleeding point. The nose should therefore be cleansed with cotton pledgets or by syringing with a warm alkaline or common salt solution. Hot water alone is sometimes efficacious. If the bleeding area is small, pressure with a bit of gauze may be sufficient. It is well to coat the gauze with a bit of soft-rubber tissue, so that its removal will not start up the bleeding afresh. The application of the solid silver stick often stops the hemorrhage instantly, although it is well to protect the area subsequently with a bit of cotton. Instead of the silver we may use chromic acid or the galvanocautery heated to a dull cherry red. If the bleeding comes from a point which we cannot definitely locate, such local measures are inapplicable, and we may use a syringeful of pure hydrogen peroxide. This generally causes immediate cessation of the flow, and gives us time in which to arrange more permanent measures. Cocaine and adrenalin solutions are not of much service in checking bleeding which has been going on for some time, for the flow prevents proper absorption of these remedies. Occasionally, however, adrenalin will under these conditions act surprisingly well.

When it becomes necessary to pack the naris a long strip of gauze not over half an inch in width may be used either dry or dipped in some astringent solution. We have found a 15 per cent. solution of the aceto-tartrate of alum very valuable for this purpose. It is antiseptic as well as astringent. By means of nasal dressing forceps the end of the strip is laid along the floor of the nose, which is then packed in successive loops from below upward, care being taken that the loops are carried back beyond the bleeding point. In removing the gauze it is well to moisten it by allowing it to soak up some warm alkaline solution; if it is removed when filled with dried clotted blood the bleeding may recommence. The employment of a rubber tissue mentioned above is especially serviceable here. A blind pushing of the gauze into the nostril is to be condemned, as is also the use of iron solutions, which leave a thick magma, obscuring later inspection. The antero-posterior packing is much the preferable plan.

It may happen that the bleeding point is so far back that plugging of the posterior nares is called for. The instrument generally suggested for this purpose is known as Bellocq's canula. A small soft rubber catheter is just as serviceable and far more likely to be at hand. Tipped with a little vaseline, it is passed through the naris until it appears in the pharynx, whence by means of forceps it is drawn out through the mouth. To its end is attached a cord which is passed in the manner above described. To the end of the cord hanging out of the mouth is fastened a tampon of gauze, and then by traction on the cord from the nares the tampon is drawn into the mouth, being guided by the finger up behind the soft palate into the nasopharynx and posterior naris. The manipulation is seen by reference to Fig. 391. The tampon should be so attached to the cord that one end of the latter still hangs from the mouth after the former is in position. This end is fastened to the nasal end, and the loop may be led over the ear. Such tampons should not be left in position more than twenty-four hours, owing to the possible danger of decomposition of the blood and consequent septic invasion of the Eustachian tubes. Before their removal is attempted it is well to instil a little warm oil into the nostril (the patient being recumbent), as it softens the gauze. The loop is then cut and the tampon removed by traction on the mouth end of the cord, the finger being held against the latter, so as to make the direction of traction backward and downward.

FIG. 391.



Plugging the posterior nares.

Various rubber receptacles, such as condoms, etc., have been recommended for anterior insertion, to be filled with water, which will exert elastic pressure, or with cotton. In place of anterior tampons we may use the Bernay compressed sponge, as advocated by Simpson. These sponges are made of cotton material, sterilized, and are highly absorbable, exerting by their expansion firm compression. Chappell suggests the advisability of attaching by means of collodion a piece of gutta percha on the side of the sponge corresponding to the bleeding point, so as to offer a smooth rather than a roughened surface. This facilitates removal without bleeding.

In cases of epistaxis which are an expression of some visceral lesion, as cirrhosis of the liver, etc., we may in connection with local measures order a large blister placed over the hepatic region. This is of service in alcoholic patients. So also we should always examine the condition of the heart, and order whatever may be appropriate for the individual case. In severe cases benefit has been derived by temporary ligation of a limb, so as to shut off for the time being a portion of the blood from the general circulation, and so reduce blood pressure.

Removal of Foreign Bodies. These are found more frequently in children than in adults, and should always be suspected whenever a child has a unilateral nasal discharge. The bodies are generally smooth (peas, shoe buttons, beads, etc.) and cause no pain. They may become incrusted with lime salts, and so form true rhinoliths. In attempting removal the naris should first be well illuminated and the location of the body determined. Gentle syringing will remove accumulated secretion, and the nasal probe may be of use if the body is not visible to the eye. Unless it is firmly impacted an ordinary dressing forceps will easily remove it. If it presents a smooth surface on which the forceps will not hold, a bent flat wire may be passed over it, and it can then be scooped out. If it is impacted the use of cocaine and adrenalin solutions is to be commended, as by their action on the surrounding tissues the latter contract and thus loosen the foreign body. If the latter is very far back the finger may be passed into the nasopharynx, and there held until the forceps is introduced anteriorly. Such a manœuvre prevents the pushing of the body into the nasopharynx, and will steady it until it is grasped by the forceps.

Ordinarily the foregoing manœuvres can be performed without general anæsthesia, but if the patient is unruly, and the exact location of the body cannot be determined, it is advisable to give a few whiffs of chloroform. The extraction of rhinoliths requires the employment of some kind of crushing forceps, and the mass is then removed piecemeal. In all instances no after-treatment is necessary beyond simple cleansing for a day or two. With loose bodies in the nares of very young children a blast of air through the patent nostril from a Politzer bag may expel the offending mass.

Acid Caustics. While all the caustic acids have at times been used in the nose, we now generally confine ourselves to chromic, monochloracetic and trichloracetic acids. All should be preceded by local anæsthesia, and are preferably employed fused on one side of the end of a flattened probe. Care should be taken that their action is accurately confined to the spot desired, and the rest of the nose may be protected by pledgets of cotton or by the use of special specula. Bosworth has clearly set forth the fact that the object of this class of remedies is "not to destroy tissue, but to constrict the blood-vessels, diminish nutrition, and thus counteract hypertrophy." In the latter state it is the deeper layers of the mucosa that are affected.

Consequently any merely superficial caustic destroys only the epithelial layer, while not at all reaching the true seat of the trouble.

In general, caustics are used in the nose for one of two purposes: either to destroy the vitality of the stump or pedicle of a new-growth or inflammatory excrescence, or to reduce hypertrophied tissues. Therefore the preferable plan is to lessen as much as possible the blood supply by cocaine alone or in combination with adrenalin, and then to bind down the tissue thus constringed. For this purpose chromic acid is an ideal agent. It acts by oxidation on the tissues, and is self-limited in its effects in that it becomes in the very process of oxidation of organic tissue converted into oxide of chromium, which is insoluble and inert. It can be easily handled, but must be kept from the air, for it readily deliquesces. It may be drawn in lines along the turbinal borders, or may be used in the ingenious manner suggested by M. A. Goldstein, who inserts a fine trocar and canula into the turbinated tissue parallel to the surface, then withdraws the trocar and inserts a probe on which is the chromic acid, and which projects slightly beyond the end of the canula. The whole apparatus is then withdrawn, making a continuous submucous cauterization.

The monochloracetic and trichloracetic acids are used for the same purposes as the chromic, the monochloracetic acid being slightly the stronger. They may be used on probes or cotton-carriers. A special advantage of these two agents is that after application they absorb moisture from the air. They therefore act as a moist protective dressing on the area, leaving, after their slough is detached, a smooth surface. Nitric acid is now rarely used in the nose, and the same may be said of glacial acetic acid, though the latter makes an excellent application to the stump of warty growths.

Intranasal Adhesions. These may arise from processes of disease, but more commonly follow ill-advised or carelessly performed operations within the nasal chambers, whereby the opposing surfaces become bared and are not kept separated until healing occurs on both sides. The adhesion may be small or large, soft or dense. It can be easily severed, but will quickly reform. An endeavor should be made to not merely cut through the adhesion band, but to actually remove a definite width of it. For this purpose some form of scissors with double cutting edges may be used. After section and checking of bleeding a thin spatula of gutta percha may be slid between the raw surfaces, or greased tampons may be applied or dry tampons surrounded by soft rubber tissue. The dressing should be changed daily and every care be taken to keep the surfaces apart until they have become coated with epithelium. It has been recommended to practise systematic friction of the adhesions by means of a cotton-carrier, the claim being made that it is thereby possible to thin out the adhesion-band and gradually cause it to disappear without causing any breach of surface. Others have suggested the advisability of passing a wire loop around the band and gradually tightening it from day to day, so as to slowly cut through the adhesion. Still others have employed silk threads in the same manner as for separating adhesions of fingers which have become webbed from a burn. The obvious lesson is to prevent as far as possible the occurrence of the condition. This can be done by the use of some sort of shield speculum, so that when the acid, cautery tip, or cutting instrument is applied to the tissues the opposing areas shall be protected from injury.

Electrolysis. Electrolysis in the nose is practically confined to the removal of septal spurs and deviations, rarely of certain tumors. In the former class of cases it is of value only where the septal excrescence is cartilaginous. We do not feel disposed to admit the truth of the claim that true bone is destroyed by electrolysis, although this result follows under certain conditions—electro-cauterization. The principles of application of electrolysis are the same with organic as with inorganic substances, namely, the evolution of oxygen from the positive and of hydrogen from the negative pole. The mere fact of organization of tissue does not interfere with electro-chemical decomposition.

True cartilage is destitute of nerves, and therefore of sensibility. It is equally devoid of bloodvessels, except for certain loops which here and there run in from the perichondrium. It is nourished by imbibition from the nutritive supply of the neighboring parts. In the nose it is covered by a mucosa which is both highly vascular and highly sensitive. Most of the outgrowths removable by electrolysis have here a covering of thickened mucosa and an increase of cartilaginous elements, a true hyperplasia. In cases of long standing there is generally, in addition, an infiltration of lime salts and sometimes at the base of the mass, true bone.

For electrolysis we may employ by means of modern apparatus either the street current or the usual galvanic battery. If the latter is used it should have at least thirty elements and a steady delivery of current. A rheostat and ampère metre are required, and also double needles, for the bipolar method has been found preferable to the monopolar; that is, both positive and negative needles are to be inserted into the tissue to be removed. The needles may be of either steel, iridoplatinum, or gold. Steel needles are cheap, firm, and penetrate easily. The needle ordinarily used by sailmakers is recommended on account of convenient size, finish, and especially fineness of point. Its diameter varies from 0.5 mm. to 1.5 mm., and length from 7 to 10 cm. The instrument makers furnish a more delicate apparatus, but these needles in small gutta percha handles connected with the battery wires answer every purpose. The average séance should not exceed fifteen minutes. Cocaine anæsthesia should be employed, though Garel asserts that there is only insignificant pain when the needles pierce the mucosa, and none at all when they finally rest in the area of selection. This, however, has not been the writer's experience. Not more than 30 milliampères are necessary, and 15 generally suffice. The rheostat should be placed at the maximum of resistance, and the latter slowly diminished until the proper reading is observed on the ampère meter. The aim is to detach the offending mass in a plane parallel to the normal plane of the septum.

A boric-acid wash will suffice to wash away the detritus about the needle holes, and its use should be followed by the insufflation of some antiseptic powder (aristol, nosophen, europhen, etc.). An eschar is formed which comes away in the course of eight or ten days.

Several weeks elapse before the parts finally mould down into what will be their eventual shape. Small excrescences about the line of section can be trimmed with the galvanocautery.

The advantages of this method are the following: it is bloodless, the field of operation can be kept in view throughout the entire operation; there is no inflammatory reaction; no possibility of after-intranasal adhesions or deformity; it is an alternative in certain cases of marked thickening associated with deviation of the septum where an operation for straightening is deemed likely to prove unsatisfactory, and it will often be permitted when a cutting operation would be refused by the patient. Its disadvantages are the somewhat elaborate apparatus required, the time necessary, and the fact that it is not applicable to bony growths. In general it may be said that the results effected by electrolysis can be more easily secured by other methods. The use of suprarenal extract has robbed intranasal operations of their greatest disadvantage. These can now be made perfectly bloodless. Furthermore, perforations of the septum by electrolysis (no matter how carefully used) are not beyond the bounds of possibility. However, it is a resource at our command when for any reason a cutting operation is not permitted.

Metallic Electrolysis. Under certain conditions it is possible to introduce directly into the tissues the salts of certain metals, especially the salts of copper, although zinc and iron have also been used. The mode of employment consists simply in making the positive pole of the metal to be used. This is applied directly to the mucous surface to be treated, while the negative may be placed on the back of the neck. The salt formed in the tissue by the passage of the current is an oxychloride. The advantages claimed for this method are, first, that the salts can be carried by diffusion to the most obscure and inaccessible parts; second, that these nascent salts are much more active than in their usual chemical combination; and, third, that as the pathological conditions usually lie deeply under the mucous membrane they can be reached by the impregnation of the tissues with the metallic salt far better than when it is simply applied to the mucous surface. The particular line of cases which seem to be benefited are hypertrophic rhinitis, excessive secretion of the nasal mucosa, irritable cough due to catarrh of the pharynx or larynx, and epistaxis with excoriations, etc.

Massage. Certain intranasal conditions are greatly benefited by the application of the general principles of massage modified to meet local anatomical conditions. Its general result here as elsewhere is to restore the circulation to its normal state and to remove the effects of disturbed circulatory activity. In atrophic rhinitis massage leads to an increased blood supply, and thus to a restoration of the normal intranasal moisture. In hypertrophic conditions it seems to have an alterative effect, leading to the removal of the products of nutritive hyperactivity. Certain effects may follow also from a reflex influence on more distant structures.

Undoubtedly the credit of introducing this therapy into rhinology belongs to Braun, of Trieste, who, at the Berlin Congress of 1890, gave an exposition of his method and its results after an extensive clinical experience. This author unfortunately surrounds the subject with a certain amount of difficulty by stating that the proper application of massage in this locality is very hard to acquire. There is a general insistence that the movements of the masseur shall be regular and of equal intensity, otherwise inflammatory conditions are made worse rather than better.

The two main methods of intranasal massage are stroking and vibration. In the former simple probes wound at the end with cotton are used. They should be stiff enough not to bend under pressure, and the cotton should be firmly wound and carried a short distance down the stem. Cocaine in weak solution is first applied to the parts, and they are then rubbed with the probes dipped in whatever medicated solution is indicated.

Some advise the application of a lubricant previous to massage. Braun suggests mentholated vaseline, Peruvian balsam, camphor, menthol, etc. A series of probes should be prepared, so that each portion of the nasal mucosa shall receive its due share of the topical agent. The duration of friction of each area should vary from a few seconds to a minute. It is obvious that the old leathery mucosa of a marked case of atrophic rhinitis, especially one attended with crust formation and ozæna, will require a more forcible and persistent friction than a case of hyperplastic deposit where a restoration of circulation is all that is desired. If the manœuvre is properly executed the patient will experience no pain nor will there be any hemorrhage.

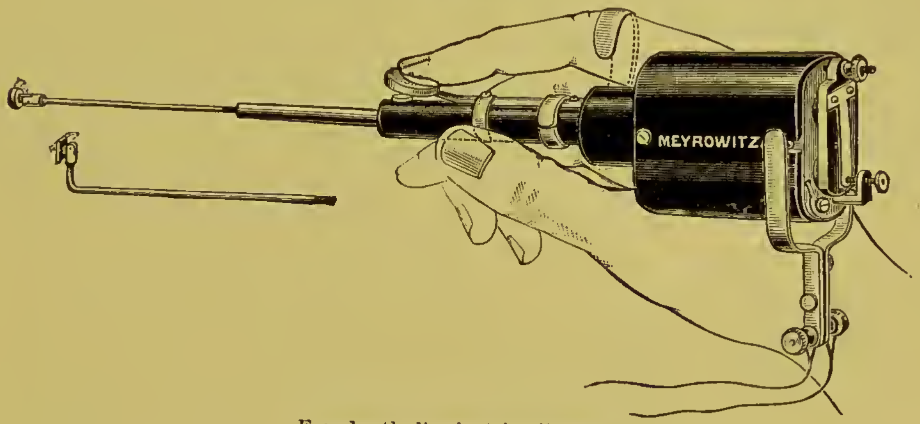
In addition to the common hypertrophic conditions and atrophic conditions, it may be added that some cases of the hay-fever type which present distinct local spots of hyperæsthesia have been benefited by friction over these areas. Such a treatment, if carried out in the intervals between attacks, has seemed to lessen the predisposition of the patient to the disease.

It seems paradoxical to prescribe the same treatment for conditions so opposite as hypertrophy and atrophy. The answer is that variation of duration and intensity of massage makes of it really two different agents so far as its effects are concerned, and that clinical experience justifies the statements made as to its curative effects in both these conditions.

Certain advantages of the method at once suggest themselves. No cumbersome apparatus is required. It is all on the examiner's table. The treatment can be definitely localized, and by a suitable bending of the probe every part of the nasal cavity can be reached. The patient bears the treatment well, and there is an entire absence of anything calculated to terrify the nervous.

In addition to the stroking or friction method we have the vibration method, which is, perhaps the one more commonly used. The fatigue attendant upon its employment has led to the application of electricity as the moving force of the probe, and several instruments have been devised for this purpose. That of Freudenthal is the most practicable. The number of vibrations can be regulated up to nearly 8000 per minute. This is, of course, a far greater number than can be reached by the manual method. Some of the statements of the rapidity of the vibrations of the arm muscles seem to the writer little short of absurd. By the electric vibrator the strength of the vibrations can be delicately adjusted. Séances should not be held oftener than two or three times weekly.

FIG. 392.



Freudenthal's electric vibrator.

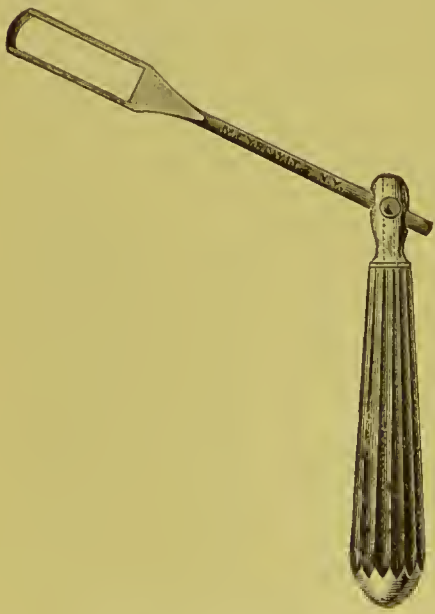
Still another and ingenious method may be mentioned, that of Dionisio, who inserts into the nasal passages a flexible rubber bag, which is then inflated with air. The bag is connected with a chamber in which, by means of a piston-action and cylinder, there is a rapid increase and decrease of air pressure. This is obviously transmitted through the tube to the bag. The method is an easy one for the physician, and several sets of tubes may be connected with the pressure chamber, and thus several patients treated at the same time. The strength and frequency of the pressure variations can be regulated to a nicety. The sensation experienced by the patient is likened to a tremor of the parts treated. Dionisio claims that in this method the vibrations are homogeneous in character and are not shocks.

Septal Spurs and Deviations. The nasal septum is rarely perfectly straight, although in the majority of cases the departure in this respect from the normal does not call for operative intervention. If for any cause the cartilaginous portion of the septum becomes markedly deviated, the turbinates on the side becoming unusually patent enlarge so as to functionally compensate, as it were, for the lessened function of those on the occluded side. It is a common experience, however, that as soon as the septum is straightened, especially in young patients, the turbinates resume their normal size. Our first duty then is to put the septum in a normal position, and the turbinates will thereafter generally take care of themselves.

For the removal of mere excrescences, such as the ordinary crests, ridges, spurs, etc., we have at our disposal various knives, the saw, and the trephine. Some of these excrescences are made up principally of mucosa, and can be removed by the cautery. Great care must be exercised in the application of this powerful agent to the cartilage itself. Reaction is apt to be severe, and if much cartilage has been attacked there may be a necrosis around the operative field. These outgrowths requiring removal may contain lime salts, and even true bone and the choice of instruments is conditioned on the finding of the composition of the part in each individual case. The probe may assist us here.

The nostril should be cleansed and then cocainized. Adrenalin may be applied subsequently to or along with cocaine. It is advisable to anæsthetize a field considerably larger than the spot to be operated upon, so that the contact of instruments with surrounding parts does not annoy the patient. Simple cartilaginous growths can be removed with a stout scalpel having a thick short blade, or with an instrument constructed on the principle of the spokeshave. The objection to many instruments of the latter class is that they are difficult to engage in the substance of the growth, and do little more than scrape off the mucosa. Where the growth is larger and the use of the knife is inapplicable we may use a gouge, chisel, or saw. The latter is in most common use, and the model of Bosworth meets every mechanical need. (Fig. 394.) Its blade is as thin as possible consistent with strength, one-eighth of an inch wide, five inches long, with a cutting-edge of three inches, with thirty teeth to the inch, each tooth being an exact equilateral triangle, with no cross-cut or

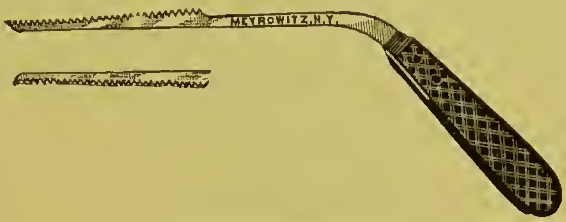
FIG. 393.



Nichols' spokeshave knife.

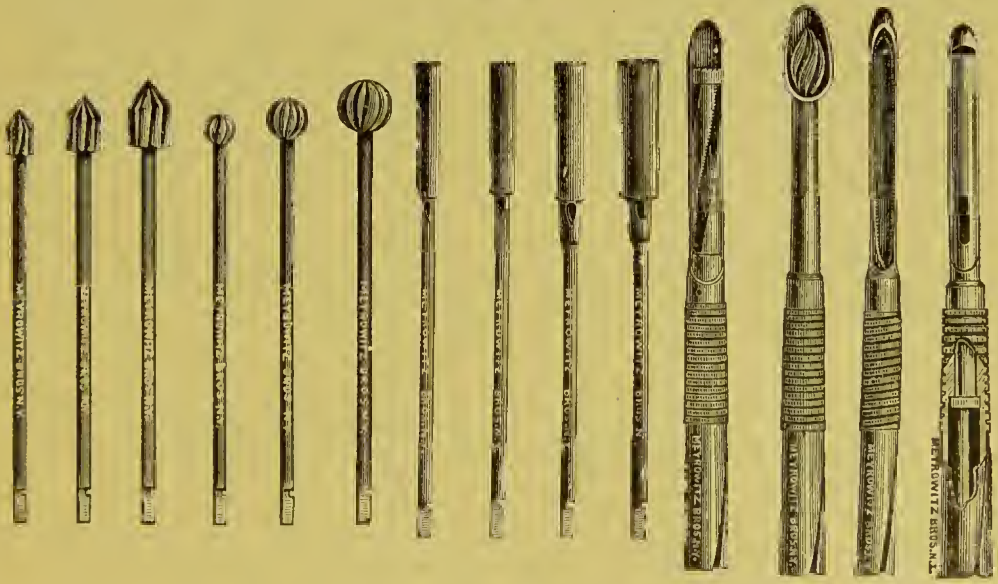
set to the teeth, the handle being three inches long and of sufficient size to be easily grasped by the hand. The cutting blade may be either upward or downward. The object is to remove the projection in such a manner as to leave the side of the septum smooth. Where the projection slopes downward toward the nasal floor it may be necessary to start with the saw blade nearly horizontal, gradually turning it toward the vertical as the plane of the septum is approached. In cases in which it is impossible to get the blade of the saw past the projection we may make a channel at the bottom by the removal of a core of tissue with the trephine in the manner to be mentioned. Through the channel thus made the saw is thrust, and by cutting either outward or upward, as the case requires, the necessary amount of tissue is removed. The saw operation is also applicable to bony outgrowths from the posterior portion of the septum. The use of adrenalin makes all these procedures practically bloodless.

Fig. 394.



Bosworth's nasal saw.

Fig. 395.



Nasal burrs and trephines.

Another method of removal of septal outgrowths is by means of burrs and trephines. (Fig. 395.) These are inserted in a flexible hand-shaft, and power is supplied either from the dental engine, driven by the foot, or by an electric motor. The preparation of the field is the same as before. The portions of tissue removed are in the form of cylindrical cores, and the borders of the cut must be trimmed by scissors or some similar instrument. The fact that the surface is not left as smooth as with the saw leads many to prefer the latter instrument.

After any of the foregoing operations the naris should be flushed out with some antiseptic solution and thoroughly dried. Some antiseptic powder should then be blown in (aristol, europhen, nosophen, etc.). Opinions differ as to the advisability of packing with gauze or inserting plugs of any kind, with a view to the prevention of hemorrhage. In any event the patient must keep quiet for the first few hours. There is bound to be a vascular reaction as the effects of the cocaine and adrenalin pass off, and if this be too active bleeding may occur. Some physicians give their patients a solution of adrenalin, with directions to use it as a matter of routine every few hours; others prefer to insert tampons, as mentioned in the paragraphs on nose-bleed. These remain in position twenty-four hours, are carefully removed, and not replaced. It is advisable for the patient to flush the nostrils two or three times daily, and whenever he is in the open air to wear a loose plug of antiseptic cotton just within the vestibule. This sifts out the dust from the inspired air, and thus furthers speedy healing. The mucosa is as a rule quickly restored.

In all the foregoing great care should be taken not to break through into the patent nostril. While no special harm results from this accident (certainly none from a physiological point of view), a septal perforation is an annoyance to the patient. Fortunately most perforations made by surgical trauma heal kindly, provided they are kept clean. During the actual time of operation a close watch should be kept on the mucosa of the sound side, so that the accident alluded to may be avoided. It has been recommended to inject sterile water under the mucosa on the sound side, corresponding to the operative field in the occluded nostril, so as to lift it up from the cartilage for the time being, and thus lessen its danger of perforation. It has been found that as the water is absorbed the tissues return to their normal condition. Patients should be cautioned not to attempt to remove the crusts which form over a healing area, as they will eventually separate of their own accord. Premature removal delays healing.

There are some cases of septal deformity in which the establishment of a permanent perforation has relieved the symptoms of which the patient has complained, but there are very few cases, if any, in which the obstruction to the breathway cannot be otherwise removed. Even if the perforation is purposely made, healing of the edges is conditioned upon the absence of any dyscrasia, careful after-treatment, and a sufficient intelligence on the part of the patient to guarantee that the wound will be protected from mechanical irritation.

Straightening of the Nasal Septum. After the removal of local excrescences the septum may still be bowed over to one side and require straightening as a whole. While many different operations have been devised with the latter end in view, that known as the Asch operation is undoubtedly applicable to more cases than is any other. Suggested by Dr. M. J. Asch some ten years ago or more, it has been given a most faithful trial and has fulfilled all the necessary requirements for restoring patency to both nostrils. The instruments are herewith shown, and as well the tubular splints for insertion in the nose. There are various models of the latter, some perforated and some solid. The perforations have never seemed to the writer to offer any advantage except that they make the splint

FIG. 396.

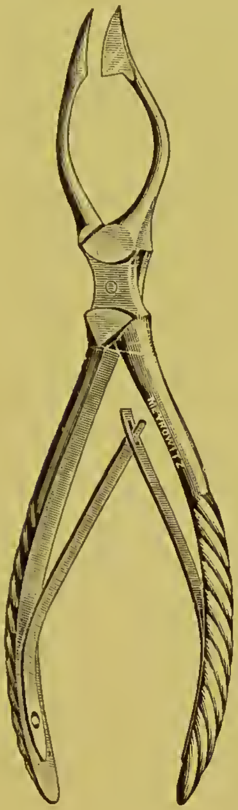


FIG. 397.

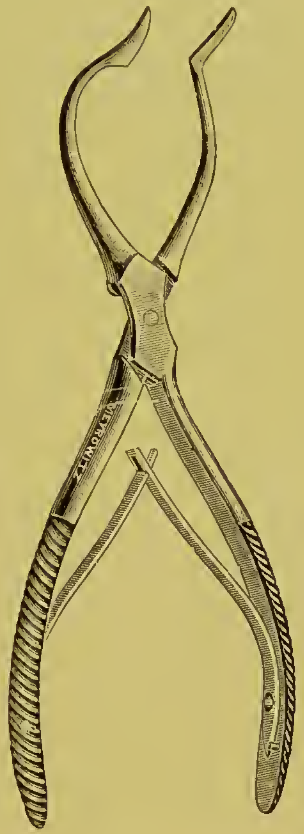


FIG. 398.

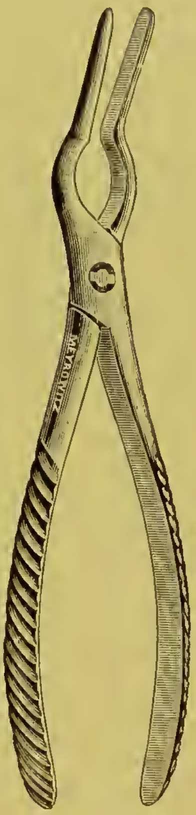


FIG. 399.

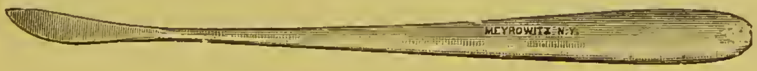
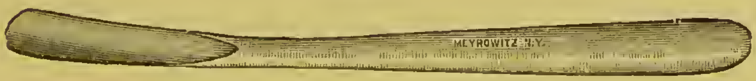


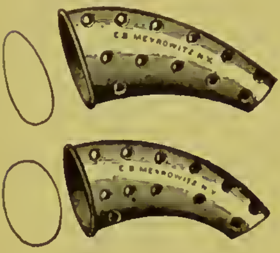
FIG. 400.



Asch's set of septum instruments.

somewhat lighter in weight. Cork splints have been used by Berens and others. But no matter what particular splint is used it is to be remembered that in each case the splint is to be fitted to the nostril, and not the nostril to the splint. Hence, we may be obliged to shorten, round off corners, etc., so as to ensure a proper fitting.

FIG. 401.



Asch's nasal splints.

The Asch operation requires general anæsthesia, but nitrous oxide will answer. Adrenalin solution should be thoroughly applied to both sides of the septum previous to the administration of the anæsthetic, although severe bleeding is uncommon, and is checked by the gentle pressure of the splint. If any adhesions exist between the septum and the turbinates they are broken up by the use of the curved gouge. The steps of the operation are thus described: The blunt blade of the scissors is inserted into the obstructed nostril, and the cutting blade into the other. A crucial incision is then made, the scissors being withdrawn for change of position in the second cut as near as possible at right angles at the point of greatest convexity. The same instrument may be used for both incisions, although two instruments are here shown. (Figs. 396 and 397.) The forefinger is then inserted into the obstructed nostril, the segments made by the incision are pushed into the opposite nostril, and the pressure continued until they are thoroughly broken up at their base and the resiliency of the septum destroyed. *On this point depends the success of the operation, for unless the fracture of these segments is assured, the resiliency of the cartilage will not be overcome, and the operation will fail.* The septum is then to be straightened with the flat-bladed forceps. The nostril is then wiped out and the tubular splint inserted on each side. These support the septal fragments and, as stated, tend to prevent secondary hemorrhage. The patient should be kept in bed for two or three days, iced cloths being laid over the nose for the relief of pain and swelling. Both sides may be sprayed out every two or three hours with an antiseptic solution. After twenty-four hours the splint on the originally patent side is removed and not replaced. The nostril is cleansed and an antiseptic powder insufflated. It is well for the patient to wear a loose plug of cotton in this side for a day or two. The tube on the originally occluded side may be allowed to remain in position for another day, when it is removed, the nostril cleansed and dusted, and the *tube replaced.* It acts, as said, as a splint for the septum, and should now be removed and cleansed daily for a week, then on alternate days, and at lengthening intervals until healing is complete. If it is properly fitted it is worn without pain, and is not visible. The patient if not too young can be taught to attend to the latter manipulations himself. The tube must be of such size that it can be inserted without any pressure, else it will gradually be crowded out by the tissues behind, and the operation will be at the most but partially successful. It should be worn for five or six weeks. If the patient can be seen daily by the surgeon, this time may be considerably shortened. Small bits of granulation tissue in the nostril may require cauterization or removal with forceps, in order to leave a perfectly smooth surface, and care should be taken to so make the crucial incisions that the tube will rest on the floor of the nose.

Another operation, devised by A. W. Watson, is especially applicable to those cases in which the deviation is marked but low down, so that it is impossible to bring the lower fragment into place. Instead of cutting out an elliptical piece, as is recommended by some authors, Watson makes a bevelled incision, the edge of the knife being directed upward and toward the opposite side and carried through the cartilage, but not the mucosa, of the opposite side. The incision is made on the crest of the deviation. If a vertical deviation exists at the same time a triangular-shaped portion with the apex uppermost must be removed. The upper portion in the horizontal incision is pressed over toward the other side, where it hooks on to the lower, and is thus held in place. The projecting base can afterward be removed.

Gleason has devised a procedure, thus described by him: The field of operation is cocainized and exposed by a self-retaining speculum. A thin saw is introduced along the floor of the septum beneath the deviation, the sawing is begun in a horizontal direction until the blade has penetrated somewhat deeply into the tissues, when the direction of sawing is rapidly changed from horizontal to nearly vertical. It is of the utmost importance that the saw should be held exactly parallel to the septum in order that the cut shall be around and not through any part of the deviation. The length of the vertical crura is then quickly increased by means of a small bistoury curved on its flat, and the flap is thrust through the hole in the septum with the forefinger.

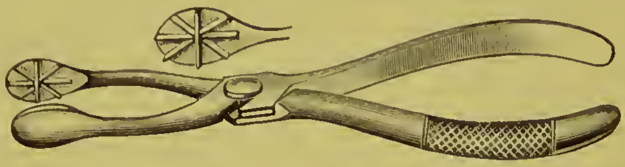
While the finger is still in the nares it is carried up along the anterior and posterior crura, in order to be certian that the edge of the flap has completely cleared them, and the neck of the flap is then sharply bent. It is not necessary to denude the edges that are in contact, as the pressure results in necrosis at least of the superficial epithelial layer of the mucosa, after which the parts unite. The special claim made for this operation is that it destroys the resiliency of the flap (a condition of success in any operation) at its neck, for it is at this point, and practically here alone, that resiliency is active, that is, at the neck of a comparatively long, narrow tongue, and hence has a powerful leverage to overcome before it can thrust the inferior edge of the flap back through the septum. The neck should be bent to nearly a right angle.

The Pin Operation. One of the earlier operations is known as the pin operation, because after the septum is crushed or fractured by the

Adams or Steele stellate forceps, causing multiple incisions, a pin is used to retain the fragments in place until healing. The pin is inserted from the concave side of the septum just back of its anterior border, passed diagonally through to the convex side, penetrating the latter, then across the vertical incision farther on into the tissues back into the septum, much as two pieces of cloth are pinned together edge to edge. It should be pushed home far enough to bring the head to lie on the septum at the point of entrance. It may be covered by a bit of rubber tubing, and care must be taken that it does not become lost in the tissues during the inflammatory swelling of the latter. It should be removed in the course of three or four weeks. In the meantime both nostrils are free for breathing, and should be kept scrupulously clean by mild antiseptic washes. Sterilized normal salt solution will answer every purpose. If the bony septum has been fractured, the pin, of course, will not penetrate it, and so the former must be kept in position by pads of antiseptic gauze renewed frequently for a week or ten days.

In addition to the foregoing varieties of septal deflections and outgrowths there are others which cannot well be brought under any well-defined category. In some the mucosa may be dissected off from the cartilage, enough of the latter removed to restore patency to the nostril, and the mucosa replaced, being held in position by fine sutures. The dissection of the mucosa is, however, rather a difficult matter. Still again, various punch-forceps have been devised, such as the one here figured. With such instruments the septum is fractured, the resiliency of the fragments destroyed, and the parts held in position by various splints or tampons. In such operations general anæsthesia is necessary, with preceding applications of adrenalin.

FIG. 402.



Stellate punch-forceps.

Forward Prolongation of the Septum. Occasionally the septum seems to have such an antero-posterior measurement that it cannot be accommodated within the bony framework designed for it. As a consequence one end appears to bend forward at one anterior naris and shows prominently, pushing the fleshy columna to the other side. The obvious symptoms due to this condition are those arising from moderate nasal obstruction, aggravated by a tendency of the alæ to collapse, excoriations from lodgement of dust, etc., on the projecting end of the septum, and dislodgement by the finger of the patient, leading to cracks and fissures. The nose seems distorted, especially on its tip. For the relief of the condition, Farlow, who has paid special attention to these cases, advises the removal of enough of the anterior end of the cartilage to relieve the tension under the skin, and in case the cartilage is occluded to cut off enough to allow free respiration. He thus describes the procedure: An incision should be made through the mucous membrane parallel with the free edge of the septum and near enough to it so that the perichondrium can be stripped back from the cartilage on both sides through one incision. When the cartilage has been bared it is trimmed until sufficient tissue has been removed to relieve pressure. If the septum deviates higher up in the other nostril, or if the deviation and prolongation are in the same nostril, it is well to make several cuts into the cartilage at right angle to the original incision, or even to remove a triangular piece from the cartilage to reduce its size and elasticity and allow it to be pushed to the other side. After the above procedures, bleeding is checked, the edges brought together, dusted, and, if necessary, a fine stitch or two taken. Healing promptly results, and the symptoms disappear.

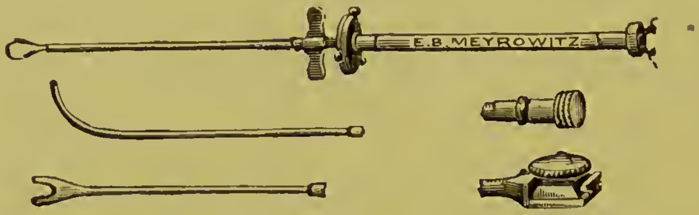
Nasal Polyps and Hypertrophies. The history of the treatment of nasal polyps presents three distinct periods. In the first period these growths were removed by applications of various caustics either applied to the surface or injected into the mass of the polyps. This caused a sloughing with its attendant danger of sepsis, though this accident does not seem to have been very frequent. Tannin was insufflated and occasionally some iron solution was injected into the mass. It is needless to say that all such plans were slow, disagreeable to the patient, and unreliable in result. Polyps were then considered tumors, and some of the older text-books still speak of them as myxomatous in nature. We now know that this is far from the truth. Myxomatous tissue is homologous with fat tissue, and both are almost unknown in the nose. Present-day teaching is to the effect that polyps are nothing but œdematous inflammatory outgrowths, merely the histological elements of the nasal mucosa under peculiar mechanical conditions.

The second period was marked by removal with forceps inserted rather blindly into the nares. The mass was grasped and pulled away by brute force. Much damage was thereby done to the delicate intranasal structures, and such use of forceps is in the light of our present knowledge inadmissible.

The third period followed the clarification of our ideas of pathology and the introduction of cocaine, which by the contraction of surrounding tissues more clearly isolated the polyps. It was seen that their bases could be encircled by a stiff wire and that they could be removed on the principle of ecrasement. The credit for perfecting this method is given by common consent to the late W. C. Jarvis, whose snare is herewith figured. (Fig. 403.)

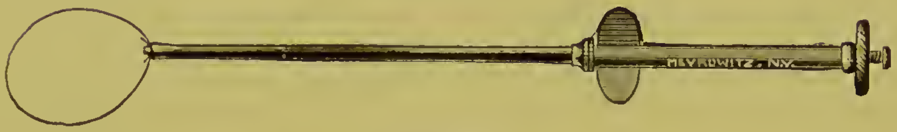
Later models substitute for the pins at the handle a screw-clamp. This snare is somewhat slow in action, but it is preferred by many, and is of special service in cases in which the polyp is situated far back in the nares, requiring the paying-out of the wire to encircle the base before the loop is tightened. Sajous modified the snare in such a way that a much shorter piece of wire is required. The principle of both instruments, however is the same. Bosworth has devised a snare in which, after the base of the polyp is encircled, but a single movement is required for detachment. Wright has combined the ideas of the three snares named in the instrument bearing his

FIG. 403.



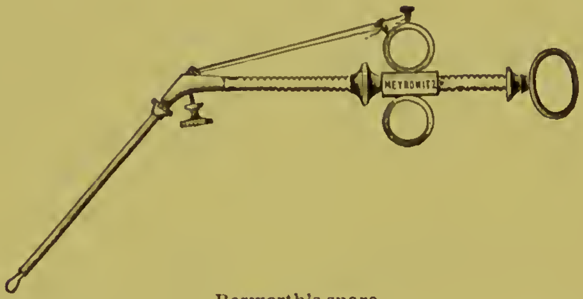
Jarvis' nasal snare.

FIG. 404.



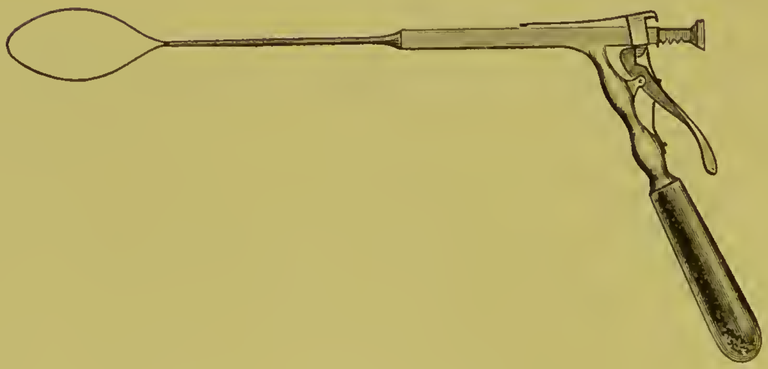
Sajous' snare.

FIG. 405.



Bosworth's snare.

FIG. 406.



Wright's snare.

name. It is a powerful and rather rapidly acting snare. It can be manipulated with one hand, however, and meets every requirement in the removal of polyps.

In the actual operation the nostril is first cocainized. As the polyps often completely block it up, it is difficult and often impossible to completely anæsthetize the operative field, but the use of a strongly-driven spray and of cotton pledgets will generally effect the desired result. Suprarenal extract may be used with a view to the prevention of bleeding, but this is rarely severe. The favorite site of polyp growth is from the edges of the hiatus semilunaris under the middle turbinate. The snare selected and threaded with No. 5 steel piano wire is passed with the loop at first vertical and then horizontal so as to slip around the polyp. Much is said about the pedicle of these growths, but we rarely see the exact seat of attachment. After the loop is passed it is gradually tightened, and just as we feel that severance is about to take place it is well to give a sudden traction, so as to remove a bit of the mucosa to which the polyp is attached. This manœuvre can be repeated until the naris is clear, the operative field being cleansed by syringing from time to time. It often happens that the patient leaves the surgeon with a nose perfectly free, but in twenty-four hours finds it as much stopped as ever. The explanation is that other polyps from practically the same or neighboring bases have been crowded by mutual pressure up into the accessory sinuses or the sinuosities of the nasal chambers, and that by the removal of the masses in front and lowest down they are by gravity and nose-blowing dislodged from their position, and thus fall down to take the place of those first removed. A continuation of treatment will finally free the nose. In regard to cauterizing the base to prevent recurrence, authorities differ. Bosworth says that he has "never been able to recognize the base from which a polypus has been severed," and consequently he thinks it unwise to subject healthy tissue to injury in the blind attempt to cauterize a region that cannot be seen.

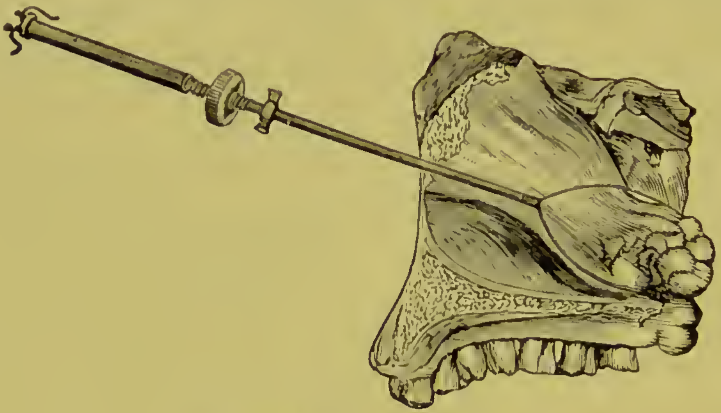
If, as occasionally happens, the polyp slips away from the wire loop, it may be held by a slender hook or forceps while the loop is adjusted. Between sittings the patient should keep the nose clean with some antiseptic solution; no other after-treatment is required.

Some have recommended the galvanocautery loop for the removal of polyps. It is not easy, however, to manipulate the soft platinum loop of this instrument. This difficulty is somewhat overcome by using iridoplatinum wire instead of simple platinum. Moreover, the current acts as a cauterizing agent and produces a slough which may be followed by inflammatory action in a region in which it is most desirable to avoid it. Sad accidents have followed the use of the cautery in any form in the region of the middle turbinate, owing to the importance of structures higher up. Electrolysis has been suggested, but this belongs to the category of curious rather than of practical therapeutics. It is tedious, and at the present time practically never used for the removal of polyps.

For the removal of nasal hypertrophies, that is, redundant turbinate tissue, the cold-wire snare is a most useful instrument. While there is a commendable reaction against the excessive zeal of a few years ago for the destruction of turbinate tissue, there are cases in which the tissue has become useless for functional purposes, and its removal is rightfully demanded. For this purpose the snare can be used as for polyps. If the amount of tissue to be removed is small or of such a shape that the wire will not easily engage around it, it may be transfixed with a needle over which the loop can be slipped.

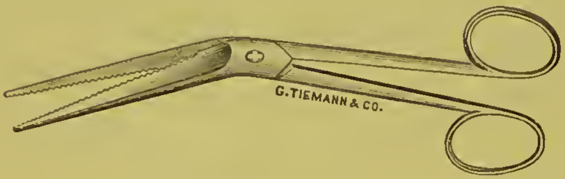
For the removal of an entire turbinate bone we may use the turbinotome, so-called, which, constructed on the principle of the spokeshave, is passed behind the mass, which is removed with a quick motion. More often the removal of only a portion is necessary, and the snare suffices. (Fig. 407.) Portions of the middle turbinate can also be removed by cutting scissors, the edges of which may be serrated, or by instruments constructed on the rongeur principle.

FIG. 407.



Snare engaging posterior turbinate

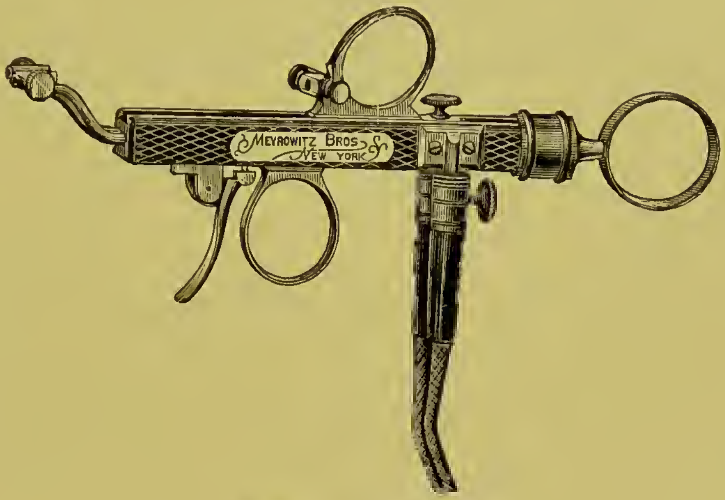
FIG. 408.



Serrated scissors.

Galvanocauterization. The use of acid caustics has already been mentioned. There remains to speak of the galvanocautery, which has come into such general employment. It is, perhaps, better adapted for work on the inferior than on the middle turbinate; if used in the latter region it should be with the greatest caution on account of the vital structures higher up. The source of electricity may be either the street current properly reduced and controlled, or any one of the various batteries. The cords should be attached to an interrupting handle, and of the many varieties on the market that known as the Schech handle answers every requirement. It can be used also for the electric snare. The various forms of cautery points are herewith figured.

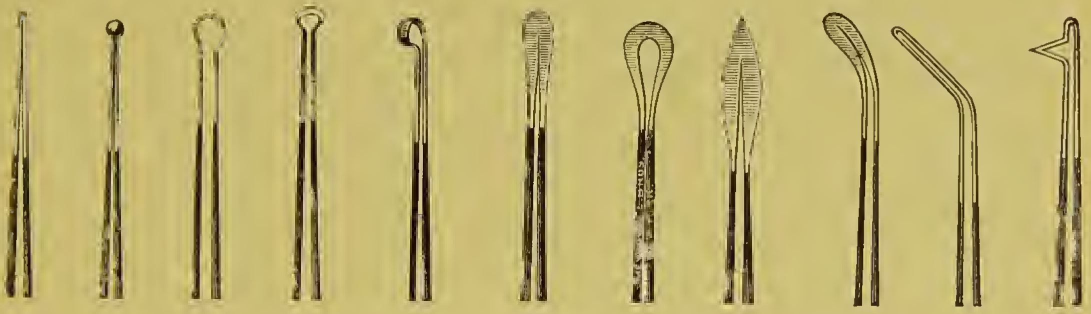
FIG. 409.



Schech cautery handle.

The part to be cauterized is anæsthetized with cocaine, and the point is then drawn along its convexity, making one or two deep furrows, the object being to pin down the redundant tissue. The electrode should be heated a little beyond cherry red. After its withdrawal the nostril should be sprayed with an antiseptic solution and a dusting powder insufflated. The patient may be given a powder of a little cocaine, bismuth, and acacia, to use on subsequent days to allay severe reaction, and he should wear cotton in the vestibule to keep out the dust. Séances may be repeated after a week or so, when the slough following the cauterization will have come away.

FIG. 410.



Cautery points.

CHAPTER XVIII.

INFLAMMATORY DISEASES OF THE UPPER AIR PASSAGES; HAY FEVER; RHINORRHŒA; ASTHMA; INFLUENZA.

By CHARLES W. RICHARDSON, M.D.

Acute Rhinitis. Acute rhinitis is an acute inflammation of the mucous membrane lining the nasal cavities. This inflammation is attended with the usual phenomena that attend acute inflammatory changes when affecting mucous surfaces in general, but is altered somewhat in the nasal chambers on account of the underlying vascular turbinal tissues. The inflammation is rarely limited to the nasal chambers, more often extending into the communicating accessory cavities, as the frontal, ethmoidal, and antral cavities, and frequently extending downward into the pharynx, larynx, or outward through the Eustachian tubes into the middle ear.

The term catarrh has been used from earliest days to designate an alteration in the physiological function of the nose characterized by an increased flow of secretion. Galen, Celsus, and others of the earlier medical authorities supposed the flux which attends this disease in the acute stage to have been an outpouring from the brain; therefore the condition was supposed to be of benefit to the affected individual, and on this account the German custom of congratulation on sneezing is supposed to have its origin.

Etiology. There is no disease in the whole range of medicine in which so many, so diversified, and often such contradictory factors apparently enter as causative elements in its production as in acute rhinitis. The predisposing factors are first to be considered. There is no doubt that as long as the bodily condition is maintained at a perfectly normal tone by proper attention to the skin, the digestive organs, and the ordinary hygienic rules with regard to clothing, exercise, ventilation, and rest, that a reasonable amount of exposure to heat and cold may be made without interfering with the physiological function of the nasal mucous membrane. The most potent predisposing cause of acute rhinitis is therefore the lowering of the bodily tone, rendering it incapable of resisting the exciting causes. Such conditions may be brought about by improper clothing, undue exposure of certain portions of the body, improper attention to the skin, acute indigestion, constipation, acute or chronic; mental excitement, and excess in mental or physical activity. The various diathetic conditions, by lowering the general tone of the individual, renders him susceptible to attacks upon the slightest exposure. This is noticed in the uric-acid diathesis, in those suffering from neurasthenia and other nervous phenomena. It is also very commonly noted that certain individuals have a marked predisposition to cold-catching, and that they will have seizure after seizure throughout the changeable season. This condition is said to be hereditary, and often manifests itself in other members of the same family. Alteration in habitat is often attended with frequent attacks of acute coryza. This is particularly noticed when the change is very marked, as when persons accustomed to live in high altitudes move to the lowlands, or where the reverse takes place. This is no doubt due to the process of acclimation and want of proper appreciation of the altered atmospheric surroundings. Those occupations which expose individuals employed in them to sudden and marked variations in the character and temperature of the atmosphere render them especially prone to cold-catching. Chronic changes within the nasal cavities or nasopharynx are a decided predisposing cause of acute rhinitis. The chronic changes which are most potent as provocative agents are spurs and deflections of the septum, chronic hypertrophic rhinitis, adenoids, and postnasal catarrh. The above enumerated chronic conditions have, by their alteration of the mucosa, placed it in a receptive state, whereby only a moderate degree of exposure under unfavorable conditions is followed by an acute attack. All ages are susceptible to attacks of acute rhinitis, although it is more frequent during child life and adolescence. The aged seem to find a certain degree of exemption from acute rhinitis. The male sex, on account of being employed in all occupations which subject them to exposure to a greater extent than the female sex, are the most frequent sufferers.

Exciting Causes. The greatest and most frequent exciting cause of an acute rhinitis is the exposure of a portion of the body to the influence of a moist atmosphere at a moderately low temperature and moving at a medium average of velocity. In other words the exposure of the body to a draught of moist air. It is a common observation that colds are much more frequent during the changeable damp weather of the fall and spring than during the extremely dry cold weather of winter or the hot weather of summer.

A temperature between 35° and 40° F. which is moist is the most active exciting cause. At certain periods of the early fall and spring, in which the above atmospheric conditions are frequent, colds seem to be epidemic. Is the epidemic the result of a given specific cause, or the result of a number of people being exposed to the same atmospheric change? A number of workers in this field have attempted to isolate a micro-organism as the active agent in acute rhinitis, among whom might be mentioned Reinsch, Hajek, Klebs, Wright, and others. While it is possible that acute rhinitis is an infectious disease, no one has yet discovered the acceptable micro-organism, nor has it been possible by inoculation with the serous exudation from the affected nasal cavities to produce the disease. The wearing of wet apparel, especially of wet or damp shoes and stockings, thus allowing a thorough chilling of an exposed portion of the body, is a very active exciting cause. The abiding in overheated and ill-ventilated places of amusements, theatres, concert-halls, office rooms, factories, and private dwellings are potent causes. Many of the acute infectious diseases are exciting factors, in that they are attended with an acute rhinitis as one of the accompanying symptoms. Such are measles, whooping-cough, scarlet fever, rötheln, typhus, intermittent fever, and smallpox. Certain drugs, chemicals, cereals, and dusts from manufacturing plants, through their physical properties or by mechanical irritation give rise to coryza. Also might be mentioned the rhinitis excited by the action of the streptococcus, erysipelatous coccus, and the gonococcus.

Symptoms. The symptoms of an acute rhinitis are usually of a mild constitutional and active local character. The invasion may be preceded by a feeling of lassitude, headache, or slight chilly sensation. The earliest and often pathognomonic local symptom of an impending cold, often manifested twenty-four hours before constitutional or other local symptoms, is a feeling of irritation, dryness, and heat in the roof of the nasal chambers and vault of the pharynx. With the onset of the attack we have a feeling of depression, headache, inability to concentrate the mind, impairment of the appetite, constipation, and a febrile disturbance varying from 99 to 100 degrees. There is impairment or complete loss of the special senses of smell and taste. The local symptoms during the first twenty-four hours are those of fulness and heat and dryness in the nasal cavity, with more or less difficulty in breathing through one or both nasal chambers. One nasal chamber may be free while its fellow is open, and this condition may quickly alternate as to the chambers affected. Sneezing during this stage is often a very pronounced and distressing symptom, and may continue so throughout the invasion until resolution is brought about. The sneezing paroxysms are more pronounced during the morning hours. At this period we have the voice more or less muffled, characterized as the nasal voice. The succeeding stage is one attended with a profuse saline serous transudation which is of an exceedingly irritating character, often causing excoriation about the alæ and upper lip. We also often notice at this time a crop of labial or nasal herpes which add greatly to the patient's discomfort. The secretion rapidly passes through the successive stages from serous to seromucous, and mucous to mucopurulent. As the discharge becomes less watery and more surcharged with broken-down and desquamated cellular elements and leucocytes, it becomes less fluid and tends to collect in incrustations. The amount of nasal stenosis existing during an attack of acute rhinitis varies greatly in different individuals and in the same individuals during different attacks. It is often noted that throughout an attack a patient may be fairly free of stenosis during the day, yet upon retiring at night it is noticed that almost immediately a complete and persistent blockage of both chambers occurs, the obstruction being more pronounced in the dependent chamber. Coughing at night is an extremely distressing symptom to many patients, and is particularly noticed in children. This night-coughing is due to the irritation excited by mouth breathing and the acrid secretion irritating an already over-sensitive pharynx. Cough may be more or less present throughout the waking hours. Besides the characteristic alteration of the voice, due to the blockage of the nose, we may have hoarseness to aphonia, due to the amount of synchronous involvement of the larynx. The severity of the headache is dependent upon the amount of fever and the extent of the implication of the ethmoidal and frontal sinuses. Early in the attack there may be noticed a feeling of stuffiness or fulness in the ears, often ringing or undue resonance of the voice, acute soreness or actual pain, and dizziness. Often in children and in severe rhinitis in adults we have acute simple or suppurative otitis. Frequently there is congestion and redness of the conjunctiva.

Diagnosis. The diagnosis is readily made from the local and constitutional symptoms present. In all cases a thorough and careful exploration of the nasal chambers should be made by anterior and posterior rhinoscopy. During the initial stage the mucous membrane will be noted as intensely livid and free from moisture, and the turbinates so swollen as to come quite or almost in contact with each other and the septum—practically obstructing the view beyond the vestibule of the nose. During the second stage the membrane will be noted to be of a deep-red color, succulent, and with desquamated cells here and there disseminated on its surface; the amount of obstruction due to turbinal engorgement is not as great as in the primary stage. During the third stage the membrane is not so vividly red, the turbinal engorgement is not so great, and the inferior and middle meatus will be noted as showing more or less mucopurulent discharge.

The complications of acute rhinitis are those conditions due to a direct extension of the inflammation through continuity. We may have extension to the accessory cavities, temporary occlusion of the lacrymal duct with epiphora, conjunctivitis, pharyngitis, temporary obstruction of the Eustachian tube, acute catarrh of the tube and the middle ear, acute simple and suppurative inflammation of the middle ear.

The **prognosis** is very favorable as to recovery. Caution should be observed as to prognosis in the very young and the aged, as extension may give rise to serious involvement of pulmonary tissue. Due effort should be made to bring about complete resolution in order to prevent the catarrh from passing into the chronic state, or the establishment of the tendency to recurrence.

Treatment. It is greatly to be deprecated that an acute rhinitis is considered such a trivial affair by the average layman, and that it is permitted in the large proportion of cases to follow its own course without effort to bring about a perfect resolution. It would be well if we could educate the laity as to the seriousness of neglected acute rhinitis, and the importance of bringing it to a quick resolution. There seems to be no doubt that during the early stage the attack can be speedily brought to resolution by resorting to abortive treatment. The patient should be put to bed, or at least confined for twenty-four or forty-eight hours within doors. This confinement is not always possible, but it is desirable when practicable. The important part in the early treatment is the restoration of the equilibrium between the disturbed action of the skin and the engorged nasal mucous membrane, which is best accomplished through active diaphoresis and local depletion. The diaphoresis can be as well excited by the administration of a copious draught of a tasteful hot drink as through the agency of drugs. The diet should be limited, better limited to a strict liquid character. A Dover's powder of 10 grains may be given, or 0.30 of bromide of quinine may be given at bedtime. As a good derivation, as well as for its active depletory effect, calomel in divided doses, followed by a saline purge in the morning, materially aids the resolution. For purposes of active local depletion I know of no remedy that acts as thoroughly as a tablet of 0.01 of chloride of sodium introduced in each nasal chamber, as suggested by Kyle. When the patient cannot be confined absolutely to the house, but is able to remain within doors the greater portion of the day, I have found codeia and ammonia carbonate, in cherry laurel water, by its mild diaphoretic action, to accomplish great good. It is administered as follows:

Codeiæ,	0.06
Ammonii carbonat.,	1.50
Syr. tolutan.,	32.00
Glycerinæ,	8.00
Aquæ lauro-cerasi.	ad 90.00

Sig.—Teaspoonful every hour until fourth dose, then every two hours.

For relief of head pain I find that applications as hot as can be borne applied to the forehead as continuously as possible afford the greatest relief. If the abortive treatment fails, as it will in many cases, the further treatment must be symptomatic. The bowels should be kept freely evacuated with morning and evening doses of sixteen grains of sodium phosphate. Acute rhinitis occurring in the lithæmic can best be combated by a strict dietary and the administration of lithia and phosphate of sodium. In the rheumatic the constitutional treatment should be the salicylates or salicin. In the malarial brisk purging with calomel, followed by the administration of quinine. Should the distention of the turbinates be so great as to give rise to distressing symptoms temporary relief may be afforded through the application of cocaine or suprarenal extract. Cocaine and suprarenal extract deplete through contraction of the turbinal vascular tissue. It is extremely unwise to place cocaine in the hands of the patient for self local administration, on account of the danger which ever exists of exciting in the individual the cocaine habit, unless it can be prescribed in such form that the patient will be totally unaware of the nature of the drug being employed. Cocaine is best used in a 4 per cent. aqueous solution. As its action is very transitory it should be repeated as frequently as every four hours. It may be used by spraying, or better, by saturating pledgets of absorbent cotton with the solution and introducing these into the nasal chamber, where they are allowed to remain a few moments, after which the cotton is removed. Suprarenal extract is a most advantageous drug for depletion by contraction, as it has even a more thorough as well as a more prolonged action than cocaine, and is unattended with any of the dangers which accompany the use of the latter drug. The suprarenal extract can be used comparatively freely, as it does not seem to have any unpleasant constitutional effects when thus used locally. It is best used according to the following formula, as suggested by Ingals, and may be introduced as directed above in the use of cocaine, or by spraying:

Adrenals (desiccated),	4.00
Acid. boric.,	1.00
Aquæ camphoræ (hot),	32 00
Aquæ destil. (hot),	32.00

M. Macerate for four hours, then filter.

In the second stage, attended with the profuse mucopurulent discharge, I find that the spraying or douching of the nose with a mild alkaline tepid solution three or four times daily gives marked relief. This solution may consist of bicarbonate and biborate of soda, 0.60 of each to 30 of tepid milk; and as good, if not better, solution for the same purpose can be made by dissolving one of the nasal plasma tablets[1] in 60 grammes of tepid water. A very comforting solution for this purpose can be made by dissolving 0.30 of sodium chloride to the ounce of tepid milk. Another excellent solution is a 3 per cent. solution of boric acid. Applications made twice daily at this stage, after this cleansing with one of the above solutions, of a menthol-camphor-iodine solution,[2] in which benzoinol or other form of refined petroleum is the menstruum, adds not only greatly to the comfort of the patient, but also materially in bringing about resolution. If the local condition seems to be following a protracted course in spite of the agents employed, it is wise to use some mild

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[1] Compressed tablet plasma nasal (Dr. Murray McFarlane):

Sodium chloride,	5½	grains.	0.3604	grammes.
Sodium sulphate,	1½	"	0.0972	"
Sodium phosphate,	¼	"	0.0162	"
Potassium chloride,	2/5	"	0.02592	"
Potassium sulphate,	¼	"	0.0162	"
Potassium phosphate,	⅓	"	0.0216	"
Menthol,	1/16	"	0.00432	"

[2] Formula for menthol-camphor-iodine solution:

Menthol,	1.50
Camphor,	0.50
Iodine,	0.03
Benzoinol,	32.00

astringent in aqueous solution to aid in bringing about resolution. The two best agents of this class are either a 1 per cent. solution of silver nitrate or chloride of zinc. The acute rhinitis occurring in early infancy is an extremely distressing affection, as through its obstruction of normal respiration it interferes seriously with the sleep, prevents the infant from nursing, and may, by impairing the nutrition, give rise to more serious complications. Great relief can be given these little sufferers by irrigating the nasal chamber with a tepid alkaline solution introduced by means of an eye dropper. The head is well held and the tip of the eye dropper is introduced just within the vestibule of the nose, and the solution forced through drop by drop until each nasal chamber is cleaned. The use of the alkaline solution can be followed by a few drops of a 1 per cent. solution of camphor in benzoinol or albolene.

Prophylaxis. It would seem irrational to close this subject of acute rhinitis without referring to the importance of prophylaxis. Proper clothing and properly protective clothing are most important in the prevention of colds. Too heavy clothing is as bad as insufficient clothing. Well-selected underclothing of medium weight is amply sufficient for use in temperate climates. Proper regard should be had to the foot covering. The shoes for out-of-door wear should have thick soles, and when allowed to become damp should be changed immediately. Rubber overshoes should always be worn on damp or rainy days. Mufflers about the neck, scarfs, and furs should be discarded. Of all means to prevent cold-catching I know of no means so potent as a moderately cool bath, between 60° and 70° F., taken every morning or evening. Chronic conditions of the nasal chamber should be corrected.

Chronic Rhinitis. Simple Chronic Rhinitis and Hypertrophic Rhinitis. Chronic rhinitis is a chronic inflammation of the mucous membrane lining the nasal cavities. It is characterized by an alteration of the mucous membrane and a change in the quantity and quality of the secretion. In the milder type the swelling of the mucous membrane is moderate and the change in the secretion more pronounced, the so-called simple chronic rhinitis. In the more severe type the swelling in the mucous membrane is greater and attended with a permanent dilatation of the bloodvessels and increased growth of the intravascular connective tissue, with an alteration of the quality of the secretion, the hypertrophic rhinitis. As a result of the swelling of the mucous membrane and increase in submucous intravascular tissue, we have more or less encroachment upon the normal lumen of the nasal chambers, whereby there is interference with free nasal respiration. This engorgement of the turbinal tissue may involve only the inferior turbinate or affect both the inferior and middle turbinate. It may show tumor-like masses affecting the anterior extremities of the inferior turbinates, or similar conditions affecting their posterior extremities. In either circumstance these enlargements are known as hypertrophies and are designated as anterior or posterior, according to their location. Ofttimes we find on the surface of the septum, especially about its cartilaginous portion, masses of erectile tissue under varying states of hypertrophy. A similar condition is often observed at the posterior border of septum, where it stands out as elliptical masses rounding out on either side of the free posterior edge of the septum as observed in the rhinoscopic mirror. The gradation between the two types of chronic rhinitis is so difficult that it is sometimes almost impossible to determine where the simple form ends and the hypertrophic begins. The application of cocaine will often enable us to make this distinct. After the application of the cocaine solution, if the swelling all disappears, the mucous membrane apparently being tightly adherent to the turbinal body, the condition is one of hyperæmia, and should be classed as a simple chronic rhinitis. If after the application of the cocaine, however, the mucous membrane does not contract down upon the turbinal bodies, but presenting here and there redundance of tissues, we recognize that we have a true hyperplasia, and the condition should be designated as a hypertrophic rhinitis.

Etiology. When one considers the physiological functions of the nasal chambers and the varying changes to which this action must accommodate itself during the twenty-four hours, we can readily understand how it can become the subject of varying degrees of disease. The various organs and structures of the body are subject, more or less, to periods of increased activity, but no organ is called upon to meet such varied changes in physiological functions as the nasal chambers. The atmosphere in its varying vagaries as to its density, humidity, and temperature, the changes produced in the atmosphere by artificial agencies, as heating and overcrowding, dust and emanations contained therein from animal contamination, all call upon the nasal chambers for varying active changes in its vascular tension. The most frequent cause of the chronic types of rhinitis is the acute rhinitis. The occurrence of frequent acute attacks which are neglected and not brought to complete resolution leave after each succeeding attack a certain amount of residual inflammation which often terminates in hypertrophy. Climatic influences no doubt exert a most potent influence in the production of hypertrophic catarrh. A moist, temperate climate, with frequent and sudden changes both in the degree of humidity and temperature, are most potent agents for the production of chronic rhinitis. The before-mentioned conditions prevail along the Atlantic seaboard and in the lake region of our country, and, as is well known, this type of catarrh is very prevalent in these regions. In the high plains of our Western country, strong winds laden with alkali dust also produce these changes. It is remarkable how a change in atmospheric surroundings will often produce a most marked temporary benefit to chronic rhinitis, the original state recurring when the patient returns to his former habitat.

I believe this improvement is often as much due to the alteration in the individual's habits of life through absence from his formal daily life, as to the alteration in the atmospheric surroundings.

The action of various admixtures which are conveyed by the atmosphere, as the dust of the streets surcharged with the excreta of animals, the dust from factories, the dusts to which stonemasons, millers, and bronze-workers are exposed, the chemicals set free by work in certain chemical factories and reducing establishments, and under this grouping could be included the inhalation of heated atmosphere observed in such occupations as that of plate-printing and bookbinding, have their deleterious effects.

The habits of life and occupation are instrumental in producing this condition. There can be no doubt that the excessive use of tobacco, either by chewing or smoking, through its constant irritation of the nasal mucous membrane and its toxic action on the vascular system, causes engorgement and chronic changes in the nasal mucous membrane. The same may be said of the action of alcohol. A sedentary occupation which permits of only a moderate degree of general muscular activity and out-of-door life, with abiding in overheated and badly ventilated rooms, exerts its deleterious influence. Various disturbances on the part of other organs or systems of the body, such as the cardiac, hepatic, gastro-intestinal, and the sympathetic nervous system are attended with changes in the nasal mucosa. Those constitutional conditions which are known as lithæmia, rheumatism, and neurasthenia, scrofula, syphilis, and tuberculosis, are all predisposing factors in chronic rhinitis. I am very much inclined to doubt whether there is a condition which might be called the catarrhal diathesis. I am more inclined to believe that the constitutional conditions just enumerated are more instrumental in producing changes of a chronic type in the nasal mucous membrane than many are willing to admit. Local changes within the nasal chambers, accessory cavities, and pharynx are often the primary disturbing factors. By far the most frequent of these local changes exerting an influence is an alteration in the nasal septum, either in the form of a deflection or of a septal spur. Through the instrumentality of spurs and deflection of the septum the nasal cavities are more or less obstructed, the air current in the nose is disturbed, the foreign substances which gain access to the nasal chambers are not removed in the usual way, the secretions accumulate, and the local nutrition suffers. When the nasal chamber is obstructed by a deflection or spur of the septum, the incoming column of air is carried over that portion of the turbinate body behind the deflection, upon which it diminishes the atmospheric pressure. This diminished atmospheric pressure when persisted in continuously, gradually results in turgescence and hyperæmia, which in turn are followed by increased tissue growth in that portion of the turbinate affected. Diseases of the accessory sinus by the irritant action of the purulent discharge upon the nasal mucosa give rise to more or less swelling of the turbinal tissue. In ethmoid disease the change produced in the middle turbinate is always very pronounced. Adenoid growths, as well as enlargement of the faucial tonsils, are very active factors as primary agents in the production of chronic rhinitis. They not only act by interfering with the return of venous blood, thus producing a passive congestion, but also by interferign with the proper ventilation of the nasal chambers.

The consideration of the etiology would be incomplete without taking into consideration the possible activity of the various micro-organisms which are found in the secretions of chronic nasal catarrh. The pus-producing micro-organisms are frequently found in the secretions of chronic rhinitis, but the same organisms are never found in the substance of the mucous membrane. The micro-organisms so found are the same as those found in normal nasal chambers, and therefore have no influence in producing chronic rhinitis, which is clearly a non-infectious inflammation of the mucous membrane. Chronic rhinitis affects most frequently young adults, the male to a greater extent than the female sex.

Symptoms. The most pronounced symptoms which are noticed by the sufferer is the alteration in the nasal secretion and the obstruction to normal nasal respiration.

The nasal secretion is altered in quantity and quality. The amount of secretion normally secreted by the vascular tissue of the nasal chamber during health is about a pint during the twenty-four hours, which is taken up during the natural process of respiration by the incoming air, so as not to be appreciated as moisture within the nasal chambers. Added to this serous secretion, which may be increased or diminished as hyperæmia or hypertrophy is present, we have an increased admixture of mucus, leucocytes, and epithelial cells as a result of the engorged condition of the chronic inflamed mucous membrane. During the early stages of chronic rhinitis, when hyperæmia of the mucosa is more pronounced, we have an increase in the amount of secretion produced, the amount varying greatly in individual cases. Often patients note the amount of secretion produced by the number of handkerchiefs used during the twenty-four hours. The secretion not only is removed through the anterior nares, but often gravitates back, and is drawn out of the pharynx by the unpleasant nasal screatus which we so often notice. When the hypertrophy becomes great there is stagnation in the turbinal bodies and an interference with the exosmosis of serum, which naturally diminishes the amount of discharge. In this latter condition the patients complain of a feeling of fulness, as though secretion existed, which, blow as they may, they cannot remove. They speak of a feeling of heat and dryness. The quality of the secretion is also variable. When the discharge is abundant it is more seromucous or mucous in character. When less abundant it is more mucopurulent, showing a moderate admixture of leucocytes and epithelial cells. It often, when deficient in water elements, dries on the septum and on the turbinal bodies in the form of flaky crusts. The secretion rarely has any odor.

As a result of the vascular growth, the thickening of the mucosa and the uncertain vascular tension of the vessels composing the turbinal tissue, we have a varying amount of stenosis of the nasal chambers, and, as a result, the interference with normal nasal respiration. It is interesting to observe how the character and degree of stenosis manifests itself in the different individuals and in the same individuals at different times. The stenosis may be most marked in one nasal chamber constantly or affect one nasal chamber solely. It frequently shows a very vacillating tendency, obstructing the right cavity at one moment, the left being practically free, and, without apparent reason, suddenly reversing the situation. Many individuals note perfect freedom of breathing while moving about during the day, noticing the obstruction only when lying down to rest at night. This obstruction, which is present at night, may obstruct both nasal chambers, or may be noticed in the nasal chamber which is undermost. The change of atmospheric surroundings will often diminish or intensify the stenosis, that is, while abiding in overheated and overcrowded rooms the stenosis is usually most profound, whereas moving about in the open usually gives the greatest freedom permissible. As a result of this stenosis, and mouth-breathing, which it entails, we have resulting changes produced in the naso- and oropharynx. The changes set up in the upper pharynx are usually in the way of chronic inflammation in the mucous membrane, with increased glandular activity. As a result of these changes we have that train of symptoms often present which are due to the accumulation of thick, ropy, viscid secretion in the nasopharynx, the effort to remove this secretion being often attended with retching, nausea, and vomiting.

Another result of the nasal obstruction is enlargement of the uvula and infiltration of the pillars of the fauces. The mouth is usually dry and the tongue coated, especially on awakening in the morning.

Cough is not only frequently present, but ofttimes is an exceedingly distressing symptom. Some individuals may be practically free from coughing during the day, but upon lying down at night it quickly makes itself manifest. This night coughing is due partly to the mouth-breathing and often to the irritation of the secretion which passes into the pharynx while the patient is in a recumbent position. Cough which is present more or less during the waking hours is due to the changes excited in the pharynx and larynx.

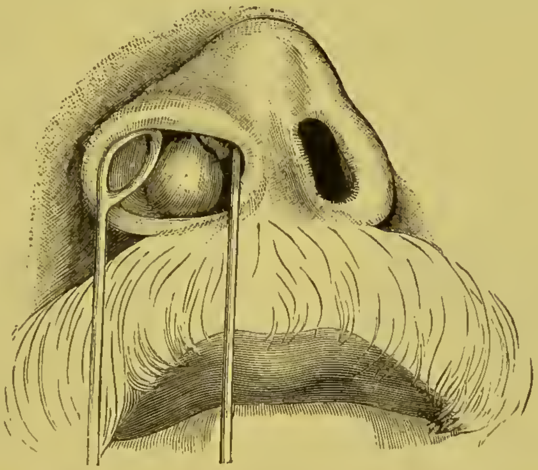
Headache is a very frequent and often very distressing symptom of chronic rhinitis. Its frequency would make it one of the most pronounced of the secondary symptoms of chronic rhinitis. Most frequently it is a brow-pain, being located over the forehead, more marked in the morning on arising, almost or quite disappearing during the day. A feeling of pressure or general fulness about the head or occipital uneasiness is often noticed. A general feeling of lassitude is frequently present in the morning. Snoring is common.

Impairment of the senses of taste and smell are occasionally present in chronic rhinitis. The obstruction of the nasal chambers as well as actual structural changes in the mucosa of the olfactory organ are responsible for these conditions. With the impairment of the olfaction we have its correlated special sense also suffering. These changes are in no sense an essential anosmia, as there is usually a complete restoration with the return to the normal.

Sneezing is a common symptom. Frequently patients have paroxysms of sneezing when rising in the morning, which subside during the preparation of the toilet. Paroxysms often manifest themselves when the patient is exposed to the direct rays of the sun. The greater the hypertrophy in the middle turbinate region the more marked is this disturbance.

The timbre and character of the voice is altered in proportion to the persistency and amount of the nasal stenosis. The voice is that characterized as nasal, and differs markedly from the voice produced by enlarged tonsils or adenoids.

FIG. 411.



Anterior rhinoscopy, showing anterior hypertrophy of inferior turbinate. (COHEN.)

The diagnosis is made complete through physical examination of the nasal chambers by anterior and posterior rhinoscopy.

By anterior rhinoscopy it will be observed that the mucous membrane is of a deep reddish appearance and quite succulent, with strands of mucus running between the turbinate bodies and the septum. In the mild types the turbinal tissue will be projected outward toward the septum in an even, round manner, nearly approaching contact with the septal walls. Often web-like crusts of dry mucus will be found in the vestibule of the nose and over the surface of the turbinate. More or less mucus is observed in the inferior meatus in this condition. In the hypertrophic form, on account of the proliferation of the cellular elements, we find the mucous membrane paler than in the hyperæmic form. The swelling of the mucosa in this type is more irregular than in the hyperæmic type, and shows a marked tendency to the development of redundances at the anterior and posterior extremities of the inferior turbinates, which often show a rugose appearance. At times the hypertrophied tissue over the anterior extremity shows almost a tumor-like swelling hanging down and filling up the inferior meatus. The greater the redundancy of tissue the paler its color. We often find hypertrophied masses of erectile-like tissue on the septum wall anteriorly. By posterior rhinoscopy we find varying degrees also of swelling of the posterior extremities of the turbinates. The posterior end of the inferior turbinates is most frequently affected, and they vary from a single rounding of the posterior extremity to large tumor-like masses that fill out the posterior nasal orifices and protrude into the pharynx. They are either rugous in appearance, or show that singular indented-like surface which has caused them to be likened to a mulberry. The color of posterior hypertrophies is grayish white. The mucosa of the posterior extremity of the septum often shows an elliptical grayish-white swelling. Through the use of cocaine and the probe we are able to differentiate with a degree of nicety the hyperæmic cases from the hypertrophic and the amount of hypertrophy present. A 5 per cent. solution of cocaine suffices for this purpose. It is best brought into contact with the mucous membrane by introducing a small pledget of cotton saturated with the cocaine solution into the nasal chambers. The cotton is allowed to remain in contact with the turbinal tissues for a moment, when it is withdrawn. After waiting a few moments for the action of the drug, on inspection we will find the mucous membrane very much contracted under the influence of the cocaine. In the simple hyperæmic condition the cavity will be quite roomy and the turbinal tissue firmly drawn down over the turbinal bodies, excepting where here and there will be noted slight swellings which will indent upon the use of the probe.

Fig. 412.

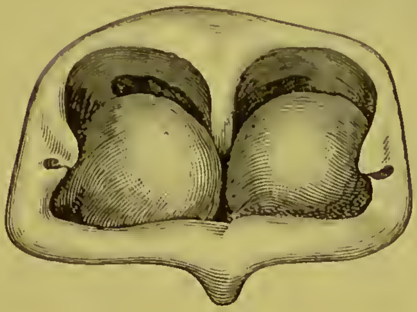


Fig. 413.

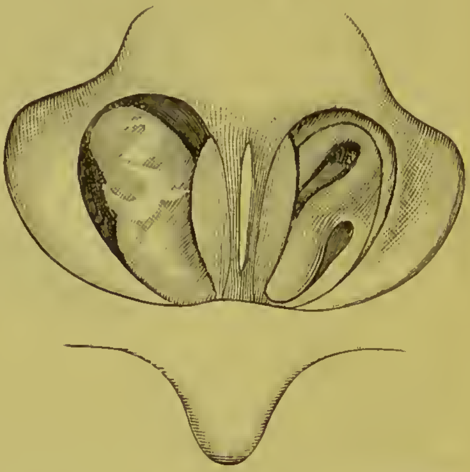


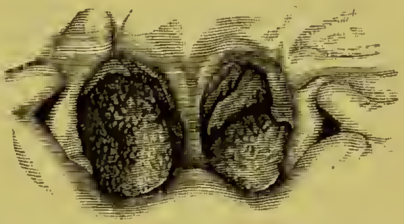
Fig. 412.—Hypertrophy of posterior extremities of inferior turbinate as observed through posterior rhinoscopy.

Fig. 413.—Elliptical swellings on posterior fundus of septum, with hypertrophy of right, middle, and inferior turbinates.

In the hypertrophic form there will also be considerable retraction; but, nevertheless, there will be noted a cushion-like mass on the anterior extremity of the inferior turbinate, slightly mobile on the use of the probe, likewise masses on the body, which are velvety to the feel of the probe and which indent upon pressure. It is remarkable how the action of cocaine causes the almost complete disappearance of posterior hypertrophies, however ponderous they may be.

We frequently note also pendulous-like masses which hang from the lower border of the middle of the inferior turbinate, and which can be lifted up from the floor of the nose. The middle turbinate presents varying degrees of swelling, showing enlargement along its inferior border, about the middle, or increase throughout its whole contour. Ofttimes we find the middle turbinate showing almost a myxomatous degenerative change, approaching, if not quite passing into the change known as ethmoiditis. It is remarkable to observe how often one nasal chamber will be continuously more seriously affected than the other. It is quite important in making these, as well as all examinations of the nasal chambers, to use the nasal probe liberally, not only before, but after the instillation of cocaine.

FIG. 414.



Mulberry-like enlargements of posterior extremities of inferior turbinate. (COHEN.)

Complications. The most frequent as well as the most distressing complications of chronic rhinitis are those due to changes in the auditory apparatus. There is no doubt that the greater proportion of all cases of middle-ear catarrh are excited through the action of chronic rhinitis. The change within the Eustachian tube and middle ear is not only due to the direct extension of the catarrhal inflammation through continuity of surface, but is also produced through the imperfect ventilation of the tube and middle ear. This rarefication of the air in the tube and middle-ear chamber, after more or less prolonged maintenance, results in hyperæmia of the mucous membrane and other changes which are designated as hypertrophic catarrh of the middle ear. This condition produces varying degrees of impairment of hearing, tinnitus, sensation of fulness in the ears, autophonia, vertigo, etc.

The eye often shows changes as a result of chronic rhinitis. We find as the result of the inflammation along the course of the lacrymal duct various changes excited within the canal. We have also simple conjunctivitis, phlyctenular conjunctivitis, and keratitis.

A number of apparently serious nervous complications result from the interference with nasal respiration. The most interesting of these is the dread of suffocation, often observed in nervous females. I have often had patients affected with hypertrophic rhinitis tell me that it was impossible to assume the recumbent position at night, on account of the sensation of impending suffocation. They have distressing dreams, pressure about the head, impairment of memory, and the inability to concentrate the mind, supra-orbital neuralgia, spasms of the muscles of the face, epileptic convulsions, asthma, and spasm of the larynx.

There is no doubt that changes of a hypertrophic character, especially about the middle turbinate, are to a marked extent a factor in giving rise to purulent conditions in the accessory sinus.

Diagnosis. The diagnosis is usually made complete by the grouping together of the subjective symptoms and the result of the rhinoscopic examination. Especially is to be emphasized the importance of making use of cocaine and the probe in the physical examination. There should be no difficulty in differentiating this condition from other affections which may involve the nasal chambers. From syphilitic infiltration and gummatous growth they can be differentiated by the absence of other lesions of syphilis, the history of infection, and the fact that infiltration and gummatous deposits do not contract under the action of cocaine, and have a dense feeling when touched with the probe; from nasal polypi by the polyp having a grayish-blue transparent appearance, being mobile, and by their pediculated well-discerned attachment about the middle turbinate. Spurs and deflections are readily differentiated from the fact that they are firm swellings affecting only the inner walls of the nasal cavity.

Prognosis. The prognosis is usually favorable, although at times it requires a protracted course of treatment. The severity of the case and the amount of hypertrophy bear no relation to the time required in the healing process. Often cases with enormous hypertrophy will yield rapidly, with relief of all symptoms, while cases with simple hyperæmia will try both the patience of the physician and the individual affected. Too much assurance should not be given to the relief of symptoms and reflex disturbances apparently due to the chronic rhinitis, as such conditions may be influenced by other pathological conditions not observable at once. The rapidity of result is often influenced to a marked extent by the patient's willingness to aid and follow all directions as to rules of hygiene.

Treatment. There is no local pathological condition within the nasal chambers that requires such a thorough consideration, both constitutional, hygienic, and local, as does the therapeutic consideration of chronic rhinitis. Without a thorough correlation of the two plans of treatment it is absolutely impossible to bring about a lasting effect as the result of treatment. The hygienic surroundings should be carefully inquired into, and wherein they are defective as regards care of the skin, clothing of the body, and protection of the feet, they should be rectified when possible. The diet of the patient should be carefully gone over, and that which is suitable to the individual should be directed and insisted upon. Frequently an office worker will be following a dietary suitable only for an athlete or a laborer. Fresh air in sleeping apartments, dwellings, and offices should be required, and the avoidance of overcrowded badly-ventilated halls and rooms of general assemblage. Exercise, good hours, and correction of habits of excess should be made obligatory when conditions demand them. Proper medication to meet constitutional disturbances that are directly or indirectly influencing the nasal changes should be considered. Removal from unfavorable occupation or climatic surroundings is not always possible, but when feasible, it should be done. And, lastly, if not least important, is the correction of any disturbed condition of the alimentary canal.

The local treatment, which plays an important rôle in the restoration to the normal of a chronic rhinitis, has for its object the reduction of hyperæmia, the removal of structural hypertorphy, the lessening of cellular and glandular activity, and the restoration of the normal physiological functions of the nasal cavity. In the milder types of hyperæmia and moderate degree of hypertrophy the local application of non-irritating alkaline solutions, to which is added some antiseptic agent in conjunction with the constitutional care, will often bring about a complete resolution. The solutions which are most applicable for such purpose are as follows:

Sodii bicarbonatis,		
Sodii boratis,		
Sodii chloridi,	āā	32.00

M. Sig.—Small teaspoonful to a pint of water.

Acidi carbol.,	.30
Sodii bicarb.,	2.00
Sodii biborat.,	3.00
Glycerinæ,	4.00
Aquæ destillat.,	180.00

M. Sig.—For local use.

To these solutions may be added, according as the condition seems to demand, any one of the astringents, as nitrate of silver in 1 per cent. solution, sulphate of zinc in 1 per cent. solution, chloride of zinc in one-half of 1 per cent. solution, and sulphocarbolate of zinc.

These solutions are introduced into the nasal chambers either by the use of the atomizer or by one of the various modifications of the nasal douche, as the Dessau or Bermingham douche. Due care should be observed to note that both nasal chambers are free enough to permit the return of fluid. Thorough care and caution should be given to the use of solutions for this purpose, and I cannot too strongly condemn the indiscriminate placing into patients' hands of various solutions with imperfect instructions as to their use or abuse. It is always better for the physician when possible to have the local treatment thoroughly within his care, allowing the patient to use only a mild alkaline solution, solely for cleansing purposes. Where astringents are used in aqueous solution it is advisable thereafter to spray out the nose with one of the forms of refined petroleum, such as albolene or benzoinol. Instead of an astringent solution, one might accomplish better results after cleansing out the nasal chambers by the use of an alterative, with a vasomotor stimulant, such as the menthol-camphor-iodine solution.

This solution is not as beneficent in its action in mild hypertrophies, but is exceedingly agreeable and pleasant in its immediate effects.

More frequently these simple measures will not be attended with the desired results, and ofttimes at the beginning the amount of structural change will demonstrate that time so employed will be wasted, and that the only method by which results can be gained is through active local treatment. Various methods have been suggested for the purpose of reducing the hypertrophies, most of which are through the use of agencies producing destruction of tissue. The method to be employed, the amount of reaction required, the agent to be employed and the success attained are largely the result of individual experience and skill. It is well to be skilled and experienced in all the various agents that are employed for this purpose, and then to use that agent which is best applicable to the case in hand and that will most thoroughly and quickly accomplish the sought-for result. The methods in vogue are pressure through soft-rubber splints, cauterization, actual or chemical, the snare, hot and cold, and the more or less complete removal of the turbinal bodies, partial or complete turbinotomy. For the technique of operative intervention reference must be directed to the chapter upon that subject. Wagner calls attention to the fact that the use of flexible metallic tubes worn for a short period for many days would bring about a resolution in hypertrophied tissue. In my observation in the wearing of splints for the correction of deformities of the septum I have been impressed with the thoroughness of the reduction of the hypertrophy in the turbinate, when any existed, and the permanency of this action. It seems as though this would therefore be a very efficient if rather unpleasant method of accomplishing a rapid and radical resolution. Electrolysis is also suggested as a method to be employed in the reduction of hypertrophies of the turbinal tissue. It is an advantageous method, as it is attended with little or no local reaction. Its chief disadvantage is the slowness with which results are obtained.

The chemical cauterizing agents are chromic and trichloracetic acid. These are especially applicable when the hypertrophy is uniform and not very marked, showing no tendency to form those masses known as anterior or posterior hypertrophies. In the application of these agents it is well to have the nasal chambers as free from moisture as possible and to make the points of application over a limited area, so as to pin down, as it were, the mucous membrane to the periosteum. If through this means a number of minute points of cauterization are made on the area of hypertrophy there will be a gradual obliteration of the overdistended venous channels and a reduction of the intravascular connective tissue as the result of the adhesion and contraction of these points. Latterly, Dr. N. H. Pierce, of Chicago, has suggested the submucous use of chromic acid, and the results of this method of application are highly satisfactory. I have found the method extremely easy in technique, and attended with uniform good results. Dr. Goldstein, of St. Louis, has suggested a special trocar and canula and cautery carrier for this purpose. The galvanocautery is useful in the same class of cases as the chemical agents, and should be used in the same manner. The galvanocautery is a most valuable agent, which unfortunately has been much abused. The disfavor into which the galvanocautery has fallen is, no doubt, largely due to the fact that through the faulty methods of its application marked reactions were frequently excited with profound constitutional disturbance. This was due to the method which was in vogue some few years ago of going through the nasal chambers with long linear cauterizations extending down to the turbinal bones. If a very finely pointed electrode is used, and from four to six minute but deep cauterizations are made, the advantage is largely in favor of the galvanocautery over the chemical agents. The galvanocautery is less painful in application, with no after-pain, its action can be more accurately gauged, and there is no violent paroxysm of sneezing and headache. In favor of the chemical cautery is the simplicity of its application and the absence of any bleeding, and the mild course of the healing process. When we have large redundant masses of tissue forming at the anterior or posterior extremity of the turbinates or hanging from the middle turbinate or the free border of the inferior turbinate, the most efficacious and most resultful method of procedure is their removal with the hot or cold snare. The hot snare is used by some in preference to the cold snare, because through its cauterization it is supposed to occlude the venous channels and prevent hemorrhage. The objection to its use is the fact that we have with its application a burnt and wounded surface. Through the introduction of the suprarenal extract and its active principle, adrenalin, we need have little fear of annoying hemorrhage with the cold snare, and as its use leaves a perfectly clean-cut wound which heals kindly,it is much to be preferred to the hot snare.

Occasionally we find large pendulous growths of hypertrophied tissue along the free border of the inferior turbinate and large infiltrated middle turbinates, the former filling up the inferior meatus and the latter coming in contact with the septum or making firm pressure thereon. The only operative intervention that will effectually reduce this form of hypertrophy is by partial or complete excision of the turbinate. Any of the various operative procedures of partial excision, as suggested by Kyle, Holmes and others, is usually attended with most satisfactory results. I find that the cutting away of the lower border of the inferior turbinate bone just through the centre of the downward curve and extending through its whole length in an antero-posterior direction, taking away as it does all the redundant tissue with a small margin of bone, results in the formation of a linear cicatrix along the whole free border of the turbinate, with a free respiratory space and sufficient turbinal tissue left to adequately carry out the physiological functions of the nasal chamber operated upon. The above-mentioned operation can be performed with scissors, saw, or conchotome.

From what results I have seen from complete turbinotomy, I am rather opposed to its application as a surgical procedure in any form of chronic rhinitis. In the few cases of complete excision of the inferior turbinate which I have seen the patients have certainly been relieved of the hypertrophy and given absolute freedom for the respiratory current, but the suffering caused by the pharyngitis sicca resulting has been manifoldly greater than the inconvenience caused by the previously existing hypertrophy. Occasionally we find large dense hypertrophies which have been vainly attacked again and again by various cautery agents, and yet they recur. The method of partial excision given above almost always gives complete relief in these cases. In summing up the treatment of chronic rhinitis I should state that a due regard must be given to the probable causative factors, and these should be removed when possible. Due attention should be paid to the constitutional condition, habits, and hygienic surroundings of the patient, and that local treatment instituted which will bring about the most satisfactory and quickest result. Overoperative treatment should be cautioned against, and the local treatment instituted should be done under as thorough asepsis as possible.

Fibrinous Rhinitis. Fibrinous or pseudomembranous rhinitis may be described as an acute inflammation of the nasal mucous membrane attended with the formation of a characteristic exudation upon the surface of the mucous membrane. In considering this subject one must recognize the fact that there are various types of false deposits in the nasal chambers which are due to different excitants, but which are often classified together. Kyle has well divided these into three types, namely, croupous or pseudomembranous rhinitis, fibrinoplastic rhinitis, and diphtheritic rhinitis. Although fibrinous rhinitis is apparently a well-defined disease which must have always attracted the attention of the rhinologist, it has only been within the last fifteen years that it has been thoroughly described and its clinical position to a certain degree definitely established. This condition is markedly a disease of child life, as it is observed in the preponderating proportion of cases in children under twelve years of age. It manifests itself in two types of membranous exudation. In the one there is an outpouring of an albuminous exudation which forms a membrane upon the surface of the mucosa and does not involve its structure. This membrane can be separated without causing bleeding, and leaves a perfectly intact mucous membrane. In the second type of cases the exudation is of a highly fibrinous coagulable material, which not only is thrown out upon the surface, but also involves the substance of the mucous membrane. This exudate as it undergoes coagulation entangles within its substance leucocytes, epithelial débris, and imperfectly formed cells. These deposits may extend throughout one or both nasal chambers, forms on the surface of turbinates and septum, is detached with great difficulty, and when attempts are made at its forcible removal there usually follows free bleeding.

Etiology. The purely croupous type of exudate is more frequently the product of local irritation where cell resistance is lowered. The irritation may be due to injury or to the action of caustics or cautery. In all probability many cases of this type of exudation observed in child life are due to mechanical irritation. Various chemical agents when inhaled, especially if there is already a solution of the continuity of the mucous membrane, will be attended with the formation of a croupous exudation. This form of membrane is seen in its purest type as occasionally following the application of the galvano-cautery. The membrane thus occurring shows itself as a grayish-white, thick, albuminous, semitransparent deposit, more or less adherent at the point of injury, but only feebly adherent over the remaining portion of the mucosa, upon which it rests. This type of membranous rhinitis is as frequently observed in the adult as in childhood. The etiology of the true fibrinous deposit as occurring in the nasal chamber is still a subject of consideration. It is no doubt a distinctly primary condition due to the activity of various forms of cocci, or an attenuated form of the Klebs-Loeffler bacillus. Various forms of cocci have been found on bacteriological observation by different authors. The staphylococci pyogenes, the streptococci, Von Hoffman's bacillus, the pneumococci, and the micrococcus lanceolatus are the type of cocci usually observed, while as frequently there has been observed a Klebs-Loeffler bacillus of low vitality. The relationship of this bacillus of a weak degree of virulence to the true Klebs-Loeffler bacillus of diphtheria has not been clearly defined. We know clinically that there is another type of fibrinous exudation of the nasal chamber, nasal diphtheria, attended with the presence of the Klebs-Loeffler bacillus, which in its whole clinical history is entirely different from the condition that we now have under consideration. We also know that the clinical history of fibrinous rhinitis seems to be the same, whatever form of bacillus is present. We know clinically that the true Klebs-Loeffler bacillus produces only one type of disease when present in the fauces, and the streptococci another type, which are in their clinical aspects unlike. It remains for the bacteriologists to explain to us why the different types of micro-organisms produce in the nasal chambers a clinically identical picture. According to Abbott, cultures made from the nasal chambers of a patient affected with this form of disease caused death in guinea-pigs within forty-eight hours. The deposit is usually limited to the anterior portion of the nasal chambers, over the surface of the septum, and inferior turbinate. It may be bilateral or unilateral. The membrane rarely extends beyond the limits of the nasal chambers. It is also very interesting to observe that this affection is not very infectious. It seems that in most of the cases in which infection has followed after exposure the resulting disease has been in the form of membranous rhinitis rather than true nasal or faucial diphtheria. There are several cases of faucial infection said to have occurred after exposure to fibrinous rhinitis. In the number of cases that I have had under my observation infection of others has never occurred. From our present knowledge of this condition, and especially on account of the frequency of the finding of the Klebs-Loeffler bacillus, it is prudent and advisable to make cultures of all cases and to insist upon the thorough isolation of patients.

Symptoms. This condition is frequently ushered in by more or less pronounced general symptoms. There is usually a chill or a chilly sensation. There is generally a feeling of malaise, depression, loss of appetite, thirst, and in children extreme irritability. The temperature at the onset ranges from 99° to 101° F.; after the second day the temperature runs about 100°. At other times the general symptoms are insignificant. There is nasal obstruction in the side affected, and in case both cavities are involved it is complete. At night the breathing is very distressing. There is a seropurulent discharge from the nose. There is impairment or loss of the sense of smell. Frontal headache is very marked, as well as neuralgia along the course of the fifth nerve. In little ones the nasal obstruction, the mouth-breathing, the febrile disturbance, the nasal discharge, and the disturbed rest at night form the most annoying symptoms. On examination of the nasal cavity the characteristic appearance of the condition will be observed. The vestibule of the nose will be noted to be inordinately congested, while on the septum and over the turbinates will be observed a distinct, well-defined, grayish-white membrane, which is very tough, fibrinous in character, and which can only be separated in small shreds, such separation being followed by copious bleeding. The swelling of the mucosa with the superimposed membranous deposit causes a complete and absolute occlusion of the nasal chambers.

Diagnosis. The diagnosis is usually readily made from the history, symptoms, and the local condition observed. One condition with which this disease might be confounded is that of a foreign body in the nasal chamber. In the case of a foreign body the mass of flocculent exudation which simulates croupous exudation can readily be removed, and the foreign body may be recognized on inspection or by the use of a probe. The differentiation from true nasal diphtheria is usually made without difficulty. In nasal diphtheria we have marked general symptoms attended with considerable prostration. In fibrinous rhinitis the symptoms are much milder. Nasal diphtheria is always attended with postnasal and faucial deposit, with a profuse sanguinolent seropurulent discharge. Fibrinorhinitis is almost never attended with extension to the pharynx and fauces, the discharge is more seropurulent and not very profuse, and there is absolute blockage of the nasal chambers. In nasal diphtheria we may have nephritis and paresis; in fibrinous neither of these conditions.

Prognosis. The prognosis is extremely favorable as to life. Chauveau reports a case of death, but it was apparently due to a secondary development of tubercular meningitis rather than to the membranous rhinitis. The disease follows no regular course, and has an indefinite duration. In favorable cases it lasts about ten days or two weeks, at the end of which time there is a complete exfoliation of the membrane with a gradual resolution of the inflamed mucous surface. In more unfavorable cases it may persist for a period of several weeks.

Treatment. The constitutional treatment, which seems to be the most important and resultful in this disease, has been generally along the line which has been followed in fibrinoplastic exudation when occurring elsewhere upon mucous surfaces, the first indication being the thorough opening of the bowels through the medium of fractional doses of calomel combined with bicarbonate of sodium, followed by a saline. This is followed by the administration of the tincture of the chloride of iron in 1 gramme doses every four hours. The calomel should be repeated frequently enough to keep the bowels in good condition. As there seems to be strong evidence through bacteriological investigation that many of these cases owe their existence to the presence of a bacillus identical with the bacillus of faucial diphtheria, it would be advisable, where such bacillus is found after culture experiments, to administer from 2000 to 4000 units of antitoxin, according to the age of the patient, and to repeat the dose according to the methods adopted in the treatment of faucial diphtheria. Antitoxin should, in all cases where the Klebs-Loeffler bacillus is found, give as radical and decided results as it does in faucial diphtheria. As the treatment previously employed has had no influence whatever upon the bettering or shortening of the attack, we shall look with considerable interest for the action of antitoxin in this disease. Patients should be isolated, and this should be thorough until the result of culture proves the non-existence of the Klebs-Loeffler bacillus.

Local treatment has apparently accomplished little in the improvement or shortening of the attack. Attempts at separation of the membrane seem unwise. Clearing of the nasal chambers with an alkaline antiseptic spray keeps the cavity clean and lessens absorption. Kyle recommends a 15 per cent. solution of chromic acid. I have found the best results to follow the use of a 5 per cent. solution of lactic acid. This should be carefully applied to raw surfaces with a cotton-carrier after cleansing of the nasal chambers.

Atrophic Rhinitis. Atrophic rhinitis is a chronic catarrhal inflammation of the nasal chamber having an uncertain onset and an indefinite duration, being attended during its course with increasing and progressive destruction of the glandular and epithelial structure, and the formation of crusts and scales within the nasal chambers, which occasion a distinctive odor, terminating in a true sclerosis of the nasal mucosa and atrophy of the turbinal osseous tissues.

Before entering upon a consideration of this subject we shall devote a few words to the discussion of the existence of two distinct diseases, namely, ozæna and atrophic rhinitis. Ozæna is simply a term, as its derivation implies, to designate the existence of an odor issuing from the nasal chambers, and can be applied with equal force to any diseased condition of the nasal chambers which is attended with an unpleasant exhalation, as for example, to nasal syphilitic necrosis, foreign bodies, rhinoliths, and sinus diseases. Ozæna in itself explains nothing; it simply indicates the feature which is most unpleasant and intolerable in certain diseased conditions of the nasal chambers. It is, in fact, a term which by some authors has been applied to distinguish a more severe type of atrophic rhinitis, or this disease in the most active stage of its development, wherein the crust formation is most abundant and in which the stench is the most pronounced symptom; the pathological changes and the train of subjective and objective symptoms are the same as in the condition which is more generally described as simple atrophic rhinitis. The odor may be the most pronounced and distressing symptom in atrophic rhinitis; it may come and go, it may be markedly manifested at one period of its life-history, and almost disappear at another, it may be bilateral or unilateral, and it may be influenced markedly by efforts at cleanliness and through the use of remedial agents. Under these circumstances it seems rather illogical to designate as a distinct disease a symptom which is but the product of a well-known and characteristic disease which has a well-defined clinical history and produces uniform pathological changes.

Etiology. There is no disease in rhinology in which speculation has been so rampant in the consideration of its etiological factors as in atrophic rhinitis. These theories have all been made along scientific lines, advanced by numerous authors after painstaking care and investigation; but, unfortunately, their conclusions are very divergent. No doubt this marked divergence of theories is largely due to the fact that no one has been able to trace a given case from the absolutely normal condition into the development of and through the successive stages of this disease. We are at the present time apparently as far from the universal acceptance of a tenable theory as to the etiology of atrophic rhinitis as in the beginning of the investigation. The various theories which have been advanced to explain the origin of atrophic rhinitis are of interest, and are here given:

1. The theory has been advanced that atrophic rhinitis is a sequela to and an advanced form of hypertrophic rhinitis. According to this view there is first the intravascular connective-tissue hypertrophy and cellular infiltration, followed by connective-tissue contraction, resulting in more or less destruction of the nutrient arterial supply to the mucosa and osseous structure, producing an atrophic change within the bone and mucosa.

2. That the condition is the result of an anatomical alteration in the osseous framework of the nasal chambers—(*a*) that the condition is due to abnormal widening; (*b*) that it is the result of abnormal shortness, and (*c*) that it is due to congenital shortness of the nasal fossæ (Zaufal, Hopmann, Fraenkel, Sauvage).

3. That atrophic rhinitis is the result of a purulent rhinitis in childhood, which in its later development becomes the atrophic rhinitis of adult life. This theory is strongly advocated by Bosworth.

4. That the condition is due to trophic changes. Zarniko and Bayer, who advance this theory, state through a trophoneurosis of the mucous membrane the characteristic lesions of this disease are produced.

5. As a result of suppurative changes in the accessory cavities. Michel was the first to advance the theory that suppurative changes within the accessory cavities are responsible for the occurrence of the characteristic lesions known as atrophic rhinitis. Grünwald has lately published his views along the same line, and in a very attractive manner attempts to show that this condition is due to lesions originating in the sinuses which communicate with the nasal chambers. Logan, in this country, has also given his adherence to this view.

6. That the disease is due to a form of rarefying osteitis. This theory has been advocated by Cholewa and Cordes. They assert that there is first an hypertrophy of the osseous structure, and as a result of this hypertrophy there is excited a pressure upon the minute nutrient vessels in the osseous canals whereby the nutrition of the mucosa at first, and latterly of the bone itself, is impaired, all of which is attended with alteration of secretion and subsequent sclerosis of mucosa and atrophy of bone.

7. As due to a constitutional vice. Störk, who advocates this theory, states that atrophic rhinitis develops in a child the product of a conception in which the father has passed through the third stage of the syphilitic infection. The child does not develop the cutaneous or other manifestations of syphilis, simply being a weakling, but later on in adolescence shows changes in the nasal chambers, which are observed to be the manifestations of atrophic rhinitis (Meisser, Gerber).

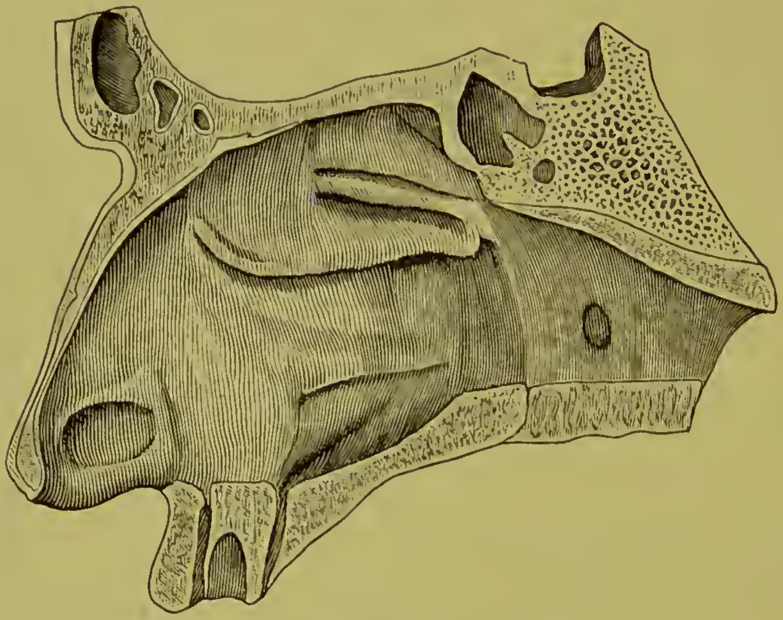
8. That the disease is the result of the activity of a specific bacillus. From the time when E. Fraenkel first made his investigations (1882) as to the probable existence of a specific bacillus in atrophic rhinitis numerous investigators have striven to separate a bacillus that should answer all the indications as the active producing agent. Among these works should be mentioned Löwenberg, Klamann, Thost, and Hajek. In 1893 Abel discovered a bacillus which he named the bacillus mucosus, and declared that it was always present in atrophic rhinitis, that it was never or very rarely found in other diseased conditions, and therefore it must be viewed as the active factor in the production of the process known as atrophic rhinitis. He also claimed that the relationship between the bacillus and the odor was simply that the secretion produced was a favorable ground and a good nutrient surface for the bacilli of putrefaction, which latter gave rise to the evil smell. Strazza found an indented bacillus which was never found in chronic or syphilitic catarrh. Paulsen also supports the theory of Abel, as he has through bacteriological investi-

gation discovered the same bacillus, and states that it is the producer of a chronic purulent rhinitis which is accompanied by fetor and leads to turbinal atrophy. Abel, in reports made after further investigation, states that whatever the stage in which the process is observed, if the essential features of the disease are present the bacillus is found. By absolute healing, that is, the disappearance of crust, fetor, and all mucopurulent discharge, the bacilli also disappear.

The exact period of life in which the atrophic changes commence is very difficult to determine. It evidently begins early in child-life. This process, like other chronic inflammations, commencing gradually without marked symptoms, does not attract the attention of the patient until the process being well advanced distresses the parents on account of the offensive odor. It has been observed as early as the fourth year of life, and I have observed well-advanced cases in children as early as the ninth, tenth, and eleventh year. In fact, the most disagreeable cases, on account of odor and well advanced in atrophy, that I have ever witnessed were manifested in two sisters of nine and eleven years. It is peculiar that the disease seems to affect the female sex more than the male. Whether the fact that women seek treatment more frequently than men for such disturbance explains the preponderance of cases observed in women over men, it is impossible to state, but I am inclined to believe that it is numerically more frequent in the gentler sex. In my experience it has been overwhelmingly more frequently observed in women than in men. This condition, while obtaining among all classes of people, is no doubt observed more frequently among the poorer classes. With us I think it appears more frequently among the first and second generations of the foreign born.

Symptoms. Usually with those affected with atrophic rhinitis we obtain a history of a long-existing catarrh. Frequently we learn that since early childhood the afflicted individual has had more or less discharge from the nose, which was purulent in character and attended with more or less excoriation of the alæ nasi or upper lip. During the early history of the individual the general health was excellent, but as the disease became more manifest there was a loss of flesh, impairment of appetite and development of anæmia. On inspection of the external nose, changes of a characteristic type will be observed in some individuals, while others manifest no change. This alteration consists in slight spreading and sinking of the nasal bones, which give an undue width to the root of the nose. The three local symptoms which characterize the disease are the secretion, the odor, and the atrophic changes. The secretion of the nasal chambers is markedly altered in this disease. The source of this secretion, whether it is the product of the catarrhal changes in the mucosa or the outpouring of discharge from within the accessory sinuses, which accumulate within the nasal chambers, is still a disputed question. While Grünwald and others may be correct in their contention that frequently atrophic rhinitis and sinusitis go hand-in-hand, the view would not explain the origin of the identical secretion in atrophic rhinitis in cases where sinusitis is known not to exist. This secretion varies greatly according to the stage in which the disease is observed. In the very early history of the cases it is inclined to be more fluid, and is frequently observed in a semiliquid state, filling the inferior meatus, while over the inferior and middle turbinates it forms soft pultaceous whitish masses which separate themselves easily from the underlying mucous membrane. As the process becomes more advanced the fluid secretion is diminished and the crust forms more or less completely over the whole mucous lining of the nasal chambers. Crusts formed in this stage are of a reddish-brown or greenish color, and scale-like, firm, and tenacious in their adherence to the mucosa. Ofttimes in this stage of the lesion complete mucous casts of the nasal chambers can be obtained by removing the crust by means of forceps. After removing crust in this state, and gently insinuating the probe above and beneath the middle turbinate and in the mucous folds in the vertex of the nose, we can often observe more or less liquid secretion. In the most advanced form, when atrophy seems quite complete, there is not much crust formation, what little forms adhering in small masses of a greenish-brown color over the depressions or on the upper surface and borders of what remains of the atrophied turbinals. Fetor is usually present in most cases during some period of the existence of the disease. The fetor varies not only in different periods of the same case, but also in different cases as to the degree of its intensity. It is a peculiar odor, which is quite characteristic, and once noted is never forgotten. The odor is characterized as a musty rat-like smell. It is usually most intense during the greatest activity of the crust-forming period, and is markedly offensive in those cases attended with large pultaceous greenish-white masses. The disagreeable stench is the most distressing symptom to the poor sufferers, and often causes almost social ostracism to young girls when so affected. The odor is not appreciated by the patient on account of the destruction of their own olfactory sense. The atrophic changes extending to the pharynx and larynx give rise to excessive dryness in the pharynx and the formation of crusts in the nasopharynx which are raised and expectorated. The voice is hoarse, and may be aphonic on arising in the morning, clearing up as the crusts are removed and the secretion excited. An irritative cough is frequently present. Hemorrhage from the nose is an occasional symptom, due to the laceration of the nasal mucosa by the separation of the crusts. Nasal obstruction, on account of the cavities being filled up with crusts, and consequent mouth-breathing, especially at night, is frequently a symptom. Headache, frontal in type, is usually present, and mental inaction with hebetude, and more or less impairment of the memory, may be present. Nervousness, hysterical manifestations, and melancholia are concomitant symptoms, usually brought about either through ostracism or the voluntary shrinking from social intercourse by the patient on account of the consciousness of the disagreeable odor emanating from the nasal chambers. The sense of smell is almost always impaired or lost. Contrary to what some observers state, I believe that perforation of the septum is unusually rare in atrophic rhinitis. I have also been impressed with the infrequency of catarrhal and suppurative changes within the middle ear in individuals affected with this disease, and, conversely, I have noted the extreme rarity of atrophic rhinitis in those applying for treatment for affections of the tube and the middle ear. Certain ocular disorders are manifest disturbances during the progress of atrophic rhinitis. Among these we may note the various forms of conjunctivitis, blepharitis, dacrocystitis, and anomalies of muscular tension. On inspection of the nasal chambers various changes will be observed affecting the soft mucous tissue according to the state in which the disease has advanced. As is well known this disease usually affects both nasal cavities and produces the changes simultaneously in both chambers; occasionally one chamber will be affected, and at a later period the other, and very rarely the disease seems to involve only one of the two chambers. On first inspecting the nasal chambers they will be observed filled with the crusts so characteristic of the disease, and these must be thoroughly removed before the exact condition of the underlying structure can be determined. One is immediately impressed with the extreme roominess of the nasal cavities. In the early stages of the disease the mucous membrane presents a pale-reddened appearance. The inferior turbinates seem somewhat shrunken, and the middle may appear somewhat pendulous, or the reverse condition may be present. Both turbinates may appear somewhat shrunken in one nasal chamber,

FIG. 415.



An advanced stage of atrophy of mucosa and bony turbinals, as seen in atrophic rhinitis.

the mucous membrane apparently drawn tightly over the surface of the turbinates, while in the other cavity one of the turbinals may seem to be hypertrophied, while the other is contracted. In a more advanced form the turbinals are considerably reduced in size, the mucous membrane contracted down firmly on the osseous framework, and of a pinkish-white, sclerosed appearance. In this state there is considerable space between the turbinals and the septum. In the more advanced stages the cicatrization of the mucosa is complete, and the inferior turbinate has undergone such complete atrophy as to appear only as a more or less prominent ridge on the outer wall of the nasal chamber, while the middle turbinate appears as a very thin plate, much shortened in its vertical dimensions. In the advanced state the atrophy of soft and osseous tissues has been so complete that a view of the pharynx can readily be obtained by anterior rhinoscopy, so that the upper surface of the soft palate, with its movements in deglutition and phonation, the mouth of the Eustachian tube, and the postpharynx can be clearly observed.

The diagnosis of atrophic rhinitis should be accomplished without much difficulty. There is hardly any other affection of the nasal chambers which presents such a clear and characteristic chain of symptoms. From a syphilitic caries or necrosis it may be readily differentiated by the presence of exposed or necrosed bone in syphilis, which is never present in atrophic rhinitis, by the difference in the odor, and by the evidences of constitutional impairment noted in the syphilitic and not observable in atrophic rhinitis; from a foreign body—in this condition we have the sudden onset, the obstruction, usually unilateral, and the presence of the object, detected by inspection through the speculum or by the use of the probe.

Prognosis. When one considers the vast amount of therapeutical material that has been brought to bear upon this disease, and with what avidity each new agent is hailed, we cannot but be impressed with the great stubbornness of the disease and how futile all efforts so far have been in bringing about a cure of the disease. I have never seen a cured case of atrophic rhinitis. I have seen cases of atrophic rhinitis that have apparently run their course, with large patulous cavities, and freedom from odor or crusts. These are spent cases, not cured cases. I would therefore state that atrophic rhinitis in the present knowledge of our therapeutic resources is not a curable disease; but under carefully carried out constitutional and local treatment it is susceptible of improvement, with a lessening of the activity of its destructive progress, with amelioration, or even a complete abeyance of its most unpleasant and annoying symptoms.

Treatment. Whatever line of local treatment is instituted it is absolutely necessary that cleanliness form the primary and essential feature of this treatment. Thorough cleansing of the nasal chambers once or twice daily with an alkaline antiseptic wash introduced by anterior and posterior injection until the solution comes through clear and free from crusts or secretion is very important. The solutions are introduced anteriorly by any of the various forms of nasal douches, preferably by those exerting only a moderate degree of pressure, and posteriorly by the postnasal syringe. Patients should be thoroughly instructed in the use of these mechanical devices and in the danger incurred by forcibly blowing of the nose during the use of the douche. As the quantity of solution which is to be used is large it is wise to select some solution which will accomplish good results without being very expensive. I know of nothing that equals a normal saline solution. This can be prepared each time by adding a teaspoonful of salt to a litre of boiled water, or by using the tablet of nasal plasma before referred to. Another solution which is also very efficacious is one composed of one teaspoonful of a 10 per cent. solution of permanganate of potash to the pint of warm water. Boric acid may be used in the strength of 10 to 30 grammes to a litre of water. In the early stages of the cleansing it will be necessary to aid the action of the solution, on account of the density and firmness of the crust, by the use of cotton-covered probes. Daily or every alternate day the patient should be carefully cleansed by the attendant physician, and he should go over the whole mucous surface as carefully as possible with a cotton-protected probe, removing all crust and pus from within the folds and duplicatures of the mucous membrane. Due caution should be observed in using instruments for douching and sprays, to see that they are as simply contrived as possible, that they are aseptically constructed, and that they admit of sterilization.

Various forms of local treatment have been suggested, mechanical and medicinal, to meet the various theories that have been suggested as to its etiological factors. Cleanliness and active irritation through the medium of irritative drugs is suggested by those believing it the second stage of a purulent catarrh. Those accepting the histological changes believe in curetting, galvanocautery, and vibrato-massage. Grünwald and his adherents resort to the opening up of diseased sinuses. Bayer and those accepting the trophoneurotic idea resort to interstitial electrolysis. Indeed, excellent results are claimed by those resorting to the use of electrolysis in the treatment of this disease, and as its application is so readily made I should strongly advise its use. While the bacteriologist has suggested the various active germicidal agents, formaldehyde and bichloride solutions, among the various local mechanical agents that have been suggested are tampons (Gottstein), use of curettes, and the action of electricity. There is no doubt that the Gottstein tampon is a valuable agent in the treatment of this condition, especially in that class of cases in which from various circumstances frequent irrigation cannot be employed. The tampon is readily made by the patient out of absorbent cotton, and is easily introduced and removed from the nasal chamber. The mass should be large enough to fit well into the nasal chamber, and should be nearly as long as the little finger. It should be well greased with a neutral non-irritating oil, or, better still, with a

25 or 50 per cent. solution of ichthyol. Where morning or evening cleansing is thoroughly resorted to it is only necessary to wear the tampon from three to four hours daily in each nasal chamber. The use of this agent will not bring about resolution; but with thorough cleansing and the use of the tampon medicated with ichthyol there will be a marked diminution in crust formation and lessening of the offensive odor. I can see no reason for the use of the curette or galvanocautery as part of the routine treatment in this ailment, nor do the advocates of vibratory or interstitial massage seem to assert any result from their treatment. This method of vibratory massage, originally instituted by Braun, is still strongly advocated by many of his adherents. It may be used by hand or motor. In this country Shurley, Price-Brown, and Bishop claim excellent results from its use. Among the local remedies that are now being used, and which seemingly exert more or less influence for good in this type of catarrh, may be mentioned formaldehyde, which may be used in the strength of 1 to 5000, gradually increasing the strength as it becomes bearable to the patient. Stearate of zinc, to which is added 1 gramme of powdered nitrate of silver to the 32 gm., insufflated into the cleansed nasal chambers, should not be used more frequently than every third day. Both of these agents are stimulating and cause more or less pain. Menthol is extensively used alone or in combination with camphor or iodine in oily solution. While I believe this a good protective and an exceedingly pleasant agent after thorough cleansing of the nasal chambers, nevertheless I cannot view its use but as aiding and abetting the progress of the disease, and therefore would advise strongly against it. In ichthyol we have an agent which, when judiciously used in connection with thorough cleansing, or in connection with cleansing and tamponing, gives results which are far superior to those attainable by any other form of treatment with which we are at present conversant. The ichthyol should at first be used in 15 per cent. solution, rapidly increased in strength until it can be borne in 75 per cent. solution, or to the full strength of the drug. The drug should be thoroughly instilled into every portion of the nasal chamber that can be reached by the attendant, at least every second day. Somers, of Philadelphia, claims great success in the lessening of crust formation and diminution of odor by the use of insufflation of a 25 per cent. powder of citric acid and sugar of milk. Careful examination should be made in all cases for diseases of communicating sinuses. The antitoxin of diphtheria has been used in treating this disease without any permanent results. In the management of all cases of atrophic rhinitis there is one feature that should strongly impress itself upon the therapeutist, and that is the manifest need of radical constitutional treatment. I have never seen a case of atrophic rhinitis in which the individual possessing it did not impress me as one who was constitutionally below par. The whole hygienic surroundings need careful overlooking and correcting whenever at fault. They should be housed, fed, bathed, and clothed

as well as is consistent with their ability to provide. They should, unless necessity forbid, live as much out-of-doors as possible. Occasional changes of climate and surroundings exert a decided beneficial influence. The correction of disordered conditions of the alimentary canal is very potent for good, especially of the habit of constipation, which is so prevalent among this class of patients. It will also be found that these patients improve more rapidly under a treatment that includes some of the following constitutional agents: iron, iodine, arsenic, cod-liver oil, or the hypophosphites.

Hay Fever or Vasomotor Catarrh.

Hay fever is characterized as a peculiar form of catarrhal inflammation of the mucous membrane of the nasal passages, occurring with a degree of periodicity. The most frequently occurring type of periodic vasomotor catarrh is that which exists during the flowering of certain plants, such as the ragweed, the grasses, and the golden rod, which in our climate usually takes place in the month of August, this form being commonly designated as hay fever. Another type makes itself manifest during the latter part of May and June in this climate, this form being commonly designated as rose-cold. Another type makes itself manifest during any period of the year, in winter as well as summer, apparently due to various sources of external irritation, and is designated as perennial vasomotor catarrh. Hay fever first attracted the attention of medical world through the able description of this condition by John Bostock, in 1819. The condition had been recognized for several centuries previous to Bostock's description. Those to whom we are indebted for our present knowledge of this disease are Phoebus, Helmholtz, Binz, Blackley, Weyman, Beard, Marsh, Daly, Hack, Roe, John Mackenzie, and Bishop.

Etiology. It is generally accepted that there is essential to the development of vasomotor catarrh the presence of three factors, which are classified as, first, a neurotic temperament; secondly, a hyperæsthetic condition of the terminal filaments of the sensory nerves, usually brought about by some local change; and thirdly, the presence of some source of local irritation. It is a well-known fact that those who suffer from the various types of vasomotor disturbances show by their very presence, their actions, their quick, nervous ways, the existence of the nervous temperament, the neurotic habit. Those affected with the ailment belong to that class of individuals who are intense in their natures and given to mental rather than physical activity. The periodicity of the attack points also strongly to its nervous character. It is more common among the better class, among those who live more or less luxuriously. It is distinctly hereditary, and often afflicts many members of the same family. It is also prevalent among those who evidence a lowered nerve activity, as the neurasthenic, although not as common as among those who show a degree of marked nervous activity. Those who are subject to the great nervous strain and mental pressure common to the environments of a great city are much more frequent sufferers from this malady than those who lead the even and unexciting existence incident to village and country life. No age seems to be exempt. It affects children of tender age as well as the aged, although more prevalent during middle adult life. The hypersensitiveness of the peripheral nerve brings up the consideration of the various local pathological disturbances which may by their existence give origin to the hypersensitive condition. The question of the existence of certain areas of hypersensitive tissue which can be located with exactness in those who are susceptible to or suffer from vasomotor catarrh cannot be doubted; but that these areas are constant and are limited to certain regions of the nasal cavities is not demonstrable. It has also been demonstrated that there are many local pathological changes in the nasal chambers which, by the irritation of the filaments of the sensory nerves distributed throughout the nasal cavities, originate reflex disturbances which aid in the production and maintenance of vasomotor catarrh. Drs. Daly, Roe, Bosworth, and Hack were the strongest and most ardent advocates of this local origin of vasomotor catarrh. Among the intranasal conditions which may be mentioned as producing local irritation are acute and chronic catarrh, hypertrophic catarrh, hypertrophy of the middle turbinate, polypi, growths of various kinds, spurs and deflections of the septum and diseases of the communicating sinuses. The presence of one of a large variety of irritating agents may be the external exciting cause. There can be no doubt that there must be some source of external irritation to furnish, as it were, the stimulus to the already irritated mucosa and the susceptible and over-charged nervous system. It is not essential that the source of local irritation should be the same in all cases. The source of irritation may be the odors of animals, various drugs, as ammonia, ipecac, salicylic acid, the dust of the roads, exposure to the direct rays of the sun, the odor of roses, and the pollen of various plants. It is quite noticeable that a perennial form of vasomotor catarrh is excited by the odor of certain animals. Since Blackley's experiments in the causation of hay fever the pollen theory as its exciting cause has been almost universally accepted. The fact that these diseases are more prevalent during the period in which the pollen of certain flowers and plants are being disseminated strengthens greatly the theory that these various pollens are the direct exciting cause of most of the cases of vasomotor catarrh. How far-reaching the local pathological changes and the sources of external irritation respectively are in producing paroxysms of vasomotor catarrh it is quite impossible to state. There is no doubt that the most essential feature is the neurotic habit. In the non-paroxysmal type of vasomotor catarrh we have as the essential element the neurotic temperament. Very rarely do we find any pathological change in these cases in the nasal chamber, other than the distended, relaxed, and pale turbinal tissue, with the outpouring of clear, watery secretion, the relief of which is in no way brought about by local treatment. Only occasionally can these patients mention any source of irritation or any condition that seems to excite an exacerbation. When such local source of irritation is given it is generally some unusual excitement which impresses upon one the peculiar nervous character of the whole disturbance. The type of nervous condition which is usually present in perennial vasomotor catarrh is that of exhausted nerve energy, neurasthenia. In the disease of hay fever and the various disturbances of this class we note one pathological feature which is ever present, and from whose presence most if not all of the symptoms originate; that condition is a vasomotor paresis.

According to Bishop and others the central disturbance is excited by an increase of uric acid in the blood, brought about by either an excessive product of the acid or a diminished excretion of the same. This perversion of nerve function, which leads to disturbances along the course of the nasal and bronchial sympathetic, may not be as much due to increase of uric acid in the blood as to other excretory elements which accumulate at times in excessive quantities in the blood. The condition of uricacidæmia has also been mentioned by numerous other authorities, and treatment directed along this line seems to be attended with marked improvement in many cases.

Symptoms. The peculiar characteristic of hay fever and rose-cold is the periodicity of the symptoms, the persistence during a certain interval, and the usual abrupt and complete subsidence. The attacks occur with marked periodicity, the patient being usually able to tell to the exact day when the invasion is to be expected. The attacks usually become more severe with each recurrence, and after a few years it is not only the upper respiratory track that is involved, but to this may be added an invasion of the bronchial mucous membrane. It is also to be noted that after several years of successive invasion the attacks do not terminate abruptly with the onset of frost, but gradually subside, while slight local irritation might provoke a full recurrence. The attack is ushered in by a sensation of dryness, fulness, and itching in the nose at the vault of the pharynx and at the inner canthus of the eye. The above-described symptoms last but for a few hours, when they are followed by violent paroxysms of sneezing, which repeat themselves again and again throughout the day. Exposure to direct sunlight or dust produces a paroxysm of sneezing almost instantaneously. There is intense itching of the conjunctivæ, increased lacrymation, and considerable photophobia. The nasal mucosa is swollen, the nasal cavities being partly or completely obstructed with a profuse watery discharge, more or less acrid in character. There is frequently a distressing cough, especially at night. There is congestion of the eyes, with more or less puffiness of the eyelids, and neuralgic pains in the eyeballs. There is frequently marked distress over the whole head, or the pain may be localized only over the frontal region, producing a sensation of great distention therein.

Evidences of tubal catarrh are not wanting, as is frequently shown by itching or soreness along the course of the Eustachian tube, a feeling of fulness or pressure in the ears, and more or less impairment of the hearing. The amount of constitutional symptoms depends to a certain degree upon the severity of the attack. There is usually more or less irritability of the temper and other manifestations of extreme disturbances of the general nervous system. The patient becomes pale, and there is a general lowering of the physical tone, as shown by lack of vigor, incapacity for mental activity, impairment of the memory, lassitude, loss of appetite, and marked disturbances of the digestive functions. The attacks of sneezing and discomfort generally subside during the night. There is occasionally a slight elevation of temperature in the evening, with the excretion of a scanty highly-colored urine. The patients frequently complain of more or less chilliness. There may be, to add to the patient's discomfort, a general hypersensitive condition of the scalp or areas here and there over the general cutaneous surface. The local appearance of the nasal mucosa shows more or less turgescence of the tissue over the turbinates, which may be so great as to make a complete obstruction of the nasal chambers, or it may be only partial, giving rise to alternate relaxation and obstruction. This swollen mucosa in recent cases presents the bright-red appearance of the ordinary hypertrophic rhinitis, but in cases of long standing the membrane has a sodden, pale appearance. The membrane is usually extremely sensitive throughout to the use of the probe. The congested mucosa is usually somewhat more resilient than simple hypertrophic tissue, and does not indent so easily at the touch of the probe. After several years of successive invasion of the hay fever, wherein only the nasal and ocular manifestations are present, we have added to these symptoms from the bronchial mucosa in the form of asthmatic paroxysms. The severity of the asthmatic seizures varies in proportion to the other symptoms. At each following invasion the asthmatic feature becomes more pronounced. The asthma of hay fever exists by day as well as by night, and may persist after the subsidence of the nasal symptoms, so that the patient becomes a confirmed asthmatic.

Diagnosis. The peculiar periodicity, the invasion at the period of the year when hay fever is persistent, and the peculiar train of symptoms makes the diagnosis a very simple matter. When to this we have added the nervous symptoms and the asthmatic attacks, the diagnosis is extremely clear.

Prognosis. The prognosis, so far as life is concerned, is favorable. When asthma has supervened the lot of the sufferer is a very unhappy one indeed. The conditions spontaneously disappear, and there seems to be a tendency for its subsidence with age. Relief can usually be obtained if the means of the sufferer will permit. Treatment is more successful in relieving the attacks and producing permanent cures than was formerly the case.

Treatment. In discussing the treatment of hay fever we shall first take up the consideration of the treatment between the attacks, (*a*) the preventive, (*b*) the constitutional, (*c*) the local; second, the treatment of the attack, (*a*) constitutional, (*b*) local.

During the interval of the attack the various etiological factors should be thoroughly considered, eliminated if possible, or their potency diminished. The general hygienic surroundings of the patient, his sanitation, as well as his physical regimen, should be carefully considered and regulated. We often find that those who are affected with hay fever are individuals who spend many hours of the day in badly ventilated and imperfectly lighted office buildings, subjected to intense nervous tension or work that requires a high degree of mental activity. These same individuals usually take no open-air exercise, and frequently spend the evenings in diversified but continuous mental strain. These people must be taught to live rationally. They must work under better hygienic surroundings, they must diminish the hours of strain, they must take active exercise in the open air, and have a more rational and suitable diet prescribed, to which they must adhere. As long as there is evidence of a deficient elimination of the products of imperfect digestion, or the accumulation of those chemical elements in the blood, only present when the relations between assimilation and elimination are not normal, the patient should be kept on a liquid diet or a very rigid diet, of which liquids form the predominant part. I usually find it expedient to give a dessertspoonful of the effervescing phosphate of soda night and morning, to be increased or diminished according to its action on the bowels. It is usually well, also, to administer three or four times daily a five-grain tablet of the effervescing citrate of lithia in a glass of water. Cold bathing, cold sponging, and the cold bag to the spine, especially in those showing vasomotor disturbances, are especially applicable. The marked neurasthenia should have the benefit of the rest cure. Among constitutional remedies certain tonics, alteratives, and nervines are found of special value. These drugs may be used singly or several in combination. Among the tonics are iron (Blaud's pill) and strychnine; among the alteratives arsenic, and among the nervines are belladonna and phosphorus. The complete cessation from occupation, removal of the apparent source of the local irritation, and change of environment, habits of life, and location are the most potent agents to bring about relief from the paroxysms. Some people seem to feel the greatest benefit from a sea voyage or the abiding on an island in the sea so distant that the influence of breezes from the mainland are lost. Others get the greatest practical benefit from going to the northern mountains and the lake regions of Canada. The White Mountains have one or more immune places. During the interval in the attacks the nasal chambers should be placed in order should there be the slightest local pathological change. Hypertrophies, polypi, deflections, and other local disturbances should be removed or corrected.

Treatment of the Attack. The best treatment for the attack is to send the patient at once to one of the immune places, there to remain until the occurrence of frost at his place of habitation. The immune place from which I have gained the greatest advantage is Bethlehem, in the White Mountains. If the patient is obliged to remain at his home, then great relief can be assured him by appropriate general and local treatment. Bishop gives during the attack teaspoonful doses of Horsford's acid phosphate two or three times daily. He claims that it lessens the uric-acid condition of the blood by lessening its solvency and aiding its elimination. He and others claim most positive results from this line of treatment. Dilute hydrochloric acid or the nitromuriatic acid might be substituted for the Horsford's acid phosphate. The diet should be regulated, the digestion corrected, and the amount of work diminished. Among constitutional remedies those that tone up the nervous system should be administered, such as iron, strychnine, and phosphorus. Among all the remedies that have been heretofore suggested for the constitutional treatment of hay fever during the attacks, I know of no drug whose action is so constant, so consistent and uniformly successful as suprarenal extract. The suprarenal extract should be given in doses of three to five-grain tablets, or the powder in capsules every two to three hours. The drug can be pushed until there is noted a feeling of vertigo, nausea, chest constriction, some slight nervous excitement, and increased activity of the heart. I have noted this mild toxic action of the drug in those with high nervous organization much earlier than in those of more robust natures. It is in the local application more than in the constitutional administration that the drug shows its distinctive usefulness. Locally the drug should be used in aqueous solution of the dry powder, prepared according to the formula suggested by Ingals. Previous to the use of the drug the nasal cavities should be well sprayed out or douched gently with a solution of biborate and bicarbonate of soda, with a few drops of carbolic acid, and then a pledget of cotton introduced into each nasal chamber saturated with the aqueous solution of the extract, and there allowed to remain for several minutes. The drug can be used also by atomization of the same solution. This may be repeated several times daily. This internal and local administration of the suprarenal extract will not always give absolute certain results, but it will give relief and more relief than almost any agent I know of, and, so far as we are aware of, with no unpleasant after-effects. Many have used this agent with the same results that I here speak of, and are as warm in its praises. I may mention Drs. Bates, Bean, Douglas, Louis S. Somers, Henry L. Swain, E. W. Wright, S. Solis Cohen, and Mullen. There is some peculiar property in the adrenalin solution that causes it to occasionally give rise to a paroxysm similar to hay fever, and I would therefore strongly advise against its use to meet the indications here outlined. Cocaine has previously been extensively used to give relief from the nasal stenosis. The effect from this drug is only transitory, possesses no degree of permanency of action, and is very prone to give rise to the habitual use of the drug. Dr. E. W. Wright, who lays great stress upon the hypersensitive condition of the nasal mucosa as the important factor in many cases, suggests a frictional massage of the mucous membrane of the nose, in order to increase its resisting powers, so that it can withstand the irritation and excitation from the impact of the pollen of plants. His method is to resort to gentle massage of the mucous membrane with a cotton-covered probe. At the meeting of the Section of Laryngology and Otology of the American Medical Association in June, 1900, Dr. H. H. Curtis read a paper upon the subject "The Immunizing Cure of Hay Fever." In this paper Dr. Curtis stated that he had, through previous suggestions in the treatment of cases, thought of the possibility of immunizing in hay fever by the administration of a tincture or fluid extract made from the flowers and pollen of the ragweed. The fluid extract and tincture of ambrosia artemisiæfolia should be given in two to ten-drop doses in water three times daily. A solution in teaspoonful doses is also prepared. There have been reported a number of successes as well as almost an equal number of failures after its use. Further use will either prove its fallaciousness or its value.

Rhinorrhœa.

This is an obscure and curious affection which is exceedingly rare, and is characterized by the escape of a profuse, thin, watery discharge from the nose.

In the consideration of rhinorrhœa we are impressed with the fact that there are two distinct types of this condition, one being attended with the discharge of a fluid from the nasal cavities, which has its origin in the arachnoid space, and the other with the escape of a similar fluid, but which is secreted from the nasal mucosa. St. Clair Thomson in his able thesis entitled "The Cerebro-spinal Fluid, Its Spontaneous Escape from the Nose," has added greatly to our knowledge of the former condition. Cases have also been reported since. Dr. Thomson has collated in his work eight undoubted cases similar to his own, and twelve cases probably of the same character. Most of these cases had been classed by various authors as ordinary cases of rhinorrhœa.

Etiology. The factors which play a rôle in the production of that class of cases which are clearly attended with the escape of cerebrospinal fluid is somewhat obscure, nevertheless it is extremely suggestive how frequently there were evidences of cerebral symptoms and retinal changes. Out of 21 cases, 17 cases exhibited cerebral symptoms, and 8 cases showed retinal changes (Thomson's reports). Fracture of the skull involving the anterior cerebral fossa is occasionally attended with the escape of a clear, limpid fluid from the nasal fossa. The nasal form of this disease is somewhat obscure as to its etiology. In most cases there seems to be a well-marked neurotic temperament which usually manifests itself by some disturbance of the sympathetic. It is supposed to be due to the impairment of the inhibitory influence of the trifacial or to stimulation of the sympathetic.

Symptoms. The affection is characterized by its chief symptom, which is the discharge of a clear watery fluid from the nose. The discharge may be bilateral or unilateral. When bilateral it indicates more frequently the nasal type, when unilateral the cerebro-spinal type. The fluid may be bland and non-irritative in character, or it may be acrid, exciting excoriation of the alæ and the upper lip. The amount of secretion may vary from a few ounces to a pint in twenty-four hours. The discharge may be continuous in its flow during the twenty-four hours, during the working hours escaping from the nose, and during sleep passing into the pharynx; or it may be intermittent, ceasing entirely while the patient is asleep. When the discharge escapes posteriorly into the pharynx during sleep we may have coughing and spasm of the glottis. The discharge may occur at periodic intervals, or, while for the most part continuous, there may be intervals of a few days wherein it ceases. The attack, when occurring at periodic intervals during the day, is usually preceded by more or less formication, itching, or paroxysms of sneezing, which subside as the flow is established In the periodic or nasal type the attack lasts only a few hours, recurs at regular or irregular intervals, and the amount of discharge is variable. In the continuous type the discharge is persistent through many months or years, and is very constant as to the amount. In nasal hydrorrhœa the discharge has no distinct point of exit; it seems to be an oozing from the general mucous surface. In cerebro-spinal rhinorrhœa the discharge is noted as issuing between the middle turbinate and the septum, high up. Examinations of the nasal chambers show very little alteration in the mucosa. The mucous membrane may be a little paler than normal, and in the advanced cases the middle turbinate may appear waterlogged. Occasionally mucous polypi are found.

Diagnosis. The diagnosis of this affection is easily made through its characteristic symptoms, the flow of a clear, limpid, watery fluid from the nasal chambers. The important feature of the diagnosis is the differentiation of the purely nasal from the cerebro-spinal rhinorrhœa, and is as follows:

Nasal Rhinorrhœa.	*Cerebro-spinal Rhinorrhœa.*
The flow is usually periodic, preceded by sneezing.	The flow is continuous. It is attended with no symptoms.
The discharge is not continuous.	
It usually ceases at night.	Does not cease during sleep.
Amount of discharge during twenty-four hours and at different periods of the day is variable.	Amount of discharge during the day and at different periods of the day is constant.
The discharge usually issues from both nasal cavities.	It is always unilateral.
The handkerchiefs moistened with the secretion, after drying are stiff.	The handkerchiefs moistened with the discharge dry soft.
Chemical examination reveals the presence of mucin and albumin, and it does not reduce Fehling's solution.	Chemical examination reveals the absence of mucin; proteids are practically absent, and it reduces Fehling's solution.

Prognosis is rather unfavorable as to improvement or cure.

Treatment. It is very important in all cases of nasal rhinorrhœa to make a careful differentiation as to the possible origin of the fluid, as it has an important bearing upon the therapeutic measures to be adopted. In the cerebro-spinal type, as indicated by St. Clair Thomson, all forms of local treatment are absolutely useless. In rhinorrhœa of a purely nasal type, partial relief may be obtained through the use of cocaine, atropine in aqueous solution, as recommended by F. Kerper, and suprarenal extract. A thorough study of the case from an etiological point of view, so as to enable one to apply that general therapeutic resource which may be of value in the individual case, is absolutely essential.

Influenza.

Influenza is an inflammation affecting the mucous membrane of the whole upper respiratory tract and the bronchial mucosa, with more or less well-marked systemic symptoms, evidently due to the action of a specific bacillus. This disease is mildly contagious, as it is frequently noticed that it spreads throughout all the members of a household when one member becomes affected. Influenza respects neither age, sex, nor social condition. It is common to all latitudes, although more prevalent and more active in the temperate and colder zones.

Etiology. From the fact that influenza is more prevalent during the fall and spring of the year, it has been stated that its prevalence at these times was due to the changes which were taking place in the atmosphere at these seasons. Its prevalence at these periods is probably more rationally explained by the lowered bodily tone incident to exposure, which renders the mucosæ susceptible to the invasion of the specific bacillus of influenza. Numerous bacilli have been described as the active agent in the production of the pathological condition known as influenza. The bacillus described by Pfeiffer is the one generally accepted as the exciting etiological factor.

Symptoms. The invasion of influenza is usually marked by very decided constitutional symptoms. There is usually a very decided chill or chilly sensation, which is followed by a rapid elevation of the temperature. There is marked prostration and bodily weakness. Loss of appetite, often intense frontal headache, intense muscular soreness, and pain in the extremities. The muscular soreness may attack any group of muscles, but most frequently affects those of the back and neck. The temperature ranges from 100° to 103° F., and is frequently irregular in its type. There is usually manifested an intense catarrhal inflammation of the whole upper respiratory and bronchial tract, with the array of symptoms incident thereto. Thus we have the usual symptoms attending a coryza, more or less soreness in the pharynx, with painful deglutition and hoarseness of the voice. The outpouring of secretion, established shortly after the invasion, is usually very copious and of a mucopurulent character. Cough is a very persistent and distressing symptom. More or less pain about the chest walls is common. Pain and discomfort in the pharynx and larynx are frequently out of all proportion to the amount of inflammation evident upon inspection. There is not only a marked degree of actual physical depression in many cases; but this is often added to and intensified by the mental depression and the disturbance of the central nervous system. Physical examination will reveal the usual changes which we have learned to note as being present in acute inflammatory disturbances of the upper air tract. In the chest we will find the usual evidences of an acute bronchial catarrh.

Prognosis. This disease usually runs its course in about ten days or two weeks, and if due care is exercised in its management it most frequently terminates in complete recovery. It is a most serious condition when affecting the very young or the aged, as the intense adynamia is prone to be followed by exhaustion of the physical power; or the extension of the inflammation into the capillary bronchi is apt to be followed by catarrhal pneumonia, either of which conditions may prove fatal. Complications are very common in this affection, and when occurring they add to its complexity and its gravity.

Complications. One of the most frequent complications in influenza is the invasion of the auditory tract. We may have tubal catarrh, simple or exudative catarrh of the middle ear, suppurative otitis, and mastoiditis. The simple and exudate catarrh are the most frequent complications in connection with the ears, and their characteristic symptoms, usually intensified in this disease, add greatly to the mental depression. The accessory sinuses are frequently affected. There is no doubt that sinusitis is frequently dependent on a previously existing attack of influenza. The antrum of Highmore, the ethmoidal and the frontal sinuses are the cavities most frequently affected. Peritonsillar abscess is a complication that occasionally presents itself, although I think it is present as a complication only in those who are subject to attacks of suppurative tonsillitis. Œdema of the glottis is rarely a complication. In some epidemics there is a marked proneness to hypertrophy of the lingual and submaxillary glands, which enlargement almost always subsides without suppuration. Pneumonia of the catarrhal type is a frequent complication of neglected cases and in the very young and aged. Various nervous phenomena may be present as complications, as evidenced by marked mental depression, hyperæsthesia and neuralgia affecting various branches of the trifacial nerve. The diagnosis of this condition is readily differentiated from acute rhinitis through the marked depression, the prominent nervous symptoms, the involvement of the lower respiratory tract, and the protracted course. In acute rhinitis the involvement of the pharynx, larynx, and lower respiratory tract when it takes place is in sequence and not synchronous.

Treatment. It is absolutely essential that patients suffering from this malady should be confined to the bed. Under no circumstances should they be allowed to move about in the open nor even within their rooms. All avoidance of bodily exertion and absolute rest is essential to prevent unfavorable complications and to avoid exhausting the patient's physical strength. The patient should be placed upon a highly nutritious liquid diet. The bowels should be well opened by fractional doses of calomel. Bromide of quinine or sulphate of cinchonidinæ should be given in small doses until the temperature has returned to the normal. Should there be evidence of much prostration, strychnine in appropriate dosage, and alcoholic stimulants should be administered. The convalescence should be assured before the patient is allowed to assume his usual vocation. Should cough prove a distressing symptom it should be relieved by appropriate treatment directed to that portion of the air-tract from the pathological disturbance of which it seems to issue, as well as by the internal administration of codeia, heroin, or cyanide of potash. Complications should be carefully watched for, and when occurring should be appropriately treated.

Asthma.

In the discussion of the general condition known as asthma we intend, under this heading, to consider the subject only in so far as it is a respiratory reflex, and to enumerate the conditions in the upper tract which may give rise to it. Asthma is a morbid condition, in many of its features closely allied to that of hay fever. Its primal causative element is at our present writing as far from solution as is the cause of hay fever. Many authors accept a somewhat similar schematic etiological chain for bronchial asthma that they have constructed for hay fever, namely. first, an inflamed hypersensitive or irritable condition of the bronchial mucosa; second, a disturbed or diseased condition of some other system or organ however remote; and third, a neurotic condition which permits of the linking of the two other conditions through the vasomotor system. This theory permits not only an explanation of the occurrence of the nasal reflex asthma, but also of all other types which seem to be of a reflex character; it in no wise attempts to explain asthma due to cardiac and bronchial disease. The attacks of asthma, as is well known, consist of well-marked paroxysms of difficult breathing, usually coming on at night, and of variable duration. The difficult breathing is excited either by a vasomotor paresis resulting in a dilatation of the bloodvessel, or by a spasm of the muscular fibres in the small bronchioles, either of which phenomenon results in a narrowing of the calibre of the bronchial tubes affected.

Morbid Conditions of the Upper Air-tract Which Excite Asthmatic Paroxysms. The most characteristic and typical nasal condition which excites paroxysms of asthma is hay fever and the allied types of vasomotor catarrh. In many cases of hay fever, with its annual recurrence, the asthmatic symptoms become the most prominent feature of the case. Nasal polypus is stated by many authors to be one of the most potent pathological changes within the nasal chamber exciting by reflex disturbances paroxysms of asthma. It is difficult to explain why the smaller growths cause this disturbance rather than the large ones, unless it be that the smaller ones irritate the mucosa, while the larger ones obtund its sensibility through pressure. Growths of other types appearing in the nasal chambers may excite the condition under consideration. The condition known as hypertrophy of the inferior turbinate is also an infrequent etiological factor in asthmatic attacks. A similar condition of hypertrophy of the middle turbinate, whether it be a simple hypertrophy or what is frequently called an œdematous degeneration or myxomatous ethmoiditis, is one of the pathological changes in the nasal cavity said to occasion asthmatic paroxysms. Among other changes within the nasal chambers which may be mentioned as causing asthma are spurs and deflections of the septum and purulent diseases of the sinuses communicating with the nasal chambers. Among those diseases of the pharynx which have been enumerated as playing an etiological rôle may be mentioned adenoids, nasopharyngeal growths, enlarged uvulæ, and hypertrophied tonsils. In considering the relationship between known existing pathological changes in the upper air-tract and asthma, it is well to bear in mind the fact that however marked the local changes from the normal may be, and how much the asthmatic paroxysms may appear dependent upon the local condition, there may be between them no pathogenic relationship whatever. This fact it is well to bear in mind in considering operative treatment of diseased conditions of the upper air-tract for the purpose of relieving the asthmatic condition, in order not to subject yourself to embarrassing failure and your patient to keen disappointments. It is well to state the probability of the relationship of cause and effect between the local morbid change and the asthmatic condition, and the probable relief that will be afforded to the one by the removal of the other; no further in the promise should one go. I have very little faith in the extreme view taken by Bosworth and others that in a large percentage of cases asthma is due to some form of intranasal disease. There is no doubt that in some asthmatics certain forms of nasal disease which may coexist may be the local excitant, and their removal may be attended with relief which may be more or less permanent. Usually, however, in order to make the relief permanent, it is necessary to correct the constitutional condition, which is equally at fault, lest some local irritation elsewhere after a time cause a recurrence of the asthma. I have seen the removal of minor pathological changes in the nose attended with subsidence of asthmatic attacks, and, on the other hand, I have seen the removal of spurs, correction of deflections, and removal of polypi in asthmatics accompanied with no result so far as the asthma was concerned.

Treatment. The local treatment should be the removal of any condition in the upper respiratory tract which is pathological and may fairly be regarded as a possible reflex excitant of the asthmatic state. There should be instituted, at the same time as the local treatment is being worked out, that form of constitutional treatment which will aid in the relief of the paroxysms and restore the general system to the normal state.

Acute Laryngitis.

Acute laryngitis is an acute inflammation of the mucous membrane of the larynx. Acute inflammation of the larynx is not so common an affection as similar catarrhal inflammation of the nose and pharynx; but, on account of the alteration in function that it calls forth, the sufferers from this condition seek medical assistance quicker than those suffering from nasal or pharyngeal inflammation.

Etiology. Exposure to cold and wet, the ordinary conditions that are productive of cold-catching, are potent in their influence in producing acute inflammation of the larynx. The form of exposure attended with the playing of a draught of air upon the head or neck is the most common exciting cause of acute laryngitis. Acute attacks are also common among those who protect their throats with mufflers, boas, and collarettes. The laryngitis produced is not so much due to the simple wearing of these forms of dress as it is the result of the loosening of them when the neck becomes warm and the sudden chilling thus produced while the neck is over-exposed. There is also no doubt that certain individuals seem to develop a proneness to acute laryngitis whenever subjected to undue exposure, while others terminate their acute colds with an acute laryngitis. The spring and fall seem to be the seasons in which this condition is most frequently developed. Those who are exposed much to the inclement weather without proper protection are also predisposed to attacks. The excessive use of alcoholic drinks seems also to be productive of this condition. Inordinate use of the voice, especially in a manner that the individual has not been accustomed to exercise it, as well as its continued and excessive use, as in exhortation, cheering, and loud calling, act as exciting causes. This is also observed in over-exertion of the voice in addressing large audiences, and the improper use of it in singing and in public speaking. Irregularities in the gastro-intestinal tract act ofttimes as a predisposing cause. The various exanthemata are often accompanied by an acute laryngeal inflammation, such as influenza, measles, variola, and more rarely scarlet and typhoid fever. Prolonged exposure to bad atmospheric surroundings and the breathing of impure air, the result of overcrowding and bad ventilation, or of an atmosphere containing vapors of chemicals, such as iodine, chlorine, bromine, sulphuric or nitric acid, are potent factors of a semitraumatic nature. Direct mechanical injury from excessive coughing, entrance of foreign bodies, and surgical manipulations produce laryngeal inflammation. Attacks are frequently due to extension of inflammation from the pharynx above or from the trachea below. There is a marked predisposition to these attacks in persons suffering from obstructions in the nasal chambers. Men are more frequently affected than women, and adults more frequently than children.

Symptoms. In describing the symptoms of acute laryngitis it would be extremely difficult, on account of the varied types, to define it in more than a general way, and then afterward more carefully enumerate the symptoms peculiar to the distinctive types. The constitutional symptoms are usually very mild in the average case of acute laryngitis, the patient simply feeling slight general uneasiness, with constipation. In some of the more severe inflammations there may be a slight febrile reaction with the usual constitutional manifestations that present themselves under such conditions. Usually the first evidence that one has of impending inflammation is a feeling of pressure or uncomfortable sensation in the larynx, which gradually becomes magnified into a feeling of soreness. There is often a peculiar raw sensation in the larynx, and the inspired air is distinctly felt as it passes over the inflamed surface. There is frequently a sensation of rawness or heat felt extending from the upper border of the larynx to the middle of the sternum. When there is marked congestion of the epiglottis or arytenoid we have painful deglutition. The tickling or dryness of the throat at first causes the patient to make frequent efforts at hemming, which is later on followed by frequent coughing. As the secretion becomes established the coughing becomes more frequent and annoying. The cough is of a peculiar bellowing, metallic character. The cough varies greatly in its character, frequency, and the rapidity of its subsidence, according to the region of the larynx affected and the intensity of the inflammation. I have usually observed that the cough is most distressing when the inflammation extends to the subcordal portion of the larynx. The conditions which intensify the cough are excessive congestion of the larynx, excessive swelling or an œdematous condition of the epiglottis and arytenoids, excessive secretion of a liquid character, or the paroxysmal cough excited by crust formation. The voice varies greatly in the extent of its involvement in different attacks and according to the extent and seat of the inflammation. Thus, when the upper portion of the larynx is involved the voice may not be affected, or only moderately altered, although it usually varies from a moderate hoarseness to complete aphonia. When the free edges of the cords are congested, or the whole vocal region and the false cords inflamed, the voice is usually intensely hoarse. Swelling in the interarytenoid region is attended with hoarseness or complete aphonia, dependent on the amount of swelling. Paresis of the crico-arytenoid internus, or arytenoideus transversus, which sometimes occurs, is attended with complete aphonia. Crust formations attendant upon laryngitis sicca are accompanied by alternating aphonia and hoarseness. The amount of the interference with respiration is in the great majority of cases only slight and practically not noticed by the patient, yet in certain forms, as in the laryngitis sicca, the hypoglottic form, and in the acute laryngitis of children, it may not only become distressing to the patient, but actually endanger the life of the affected one. At first there is an intense feeling of dryness in the larynx, but this after a period of a few hours gives rise to the outpouring of at first a seminucous secretion which gradually undergoes a change to a mucous and mucopurulent. This discharge is for a few hours abundant, but lessens rapidly as its liquid elements diminish in quantity. The secretion is at times discolored with little masses of coagulated blood or streaks of free blood. The laryngoscopic picture obtained in the more frequent simple acute laryngitis differs greatly as to the seat of the inflammation and the degree of its intensity. The whole mucous membrane of the larynx may vary from a pinkish red to a most intense scarlet red, and the vocal cords may participate in this inflammation in the same degree as the rest of the mucous membrane or appear only slightly discolored. Again the vocal bands may show vivid redness, while the remainder of the larynx is only moderately inflamed, or they may show only an intense red line of inflammation along their free borders, while the rest of the cords appear normal. The superior surface of the cords may show areas of epithelial denudation, and this condition may be manifest on the surface of the false cords, aryepiglottidean folds, and lateral walls of the larynx—superficial ulcerations. These surfaces are said to give rise to hemorrhage. There may be swelling in the interarytenoid region preventing the coaptation of the cords, while infiltration in the muscles themselves may bring about the same condition. The arytenoid region as well as the aryepiglottidean folds may not only be deeply congested, but also œdematous.

Rheumatic Laryngitis. Rheumatic or gouty laryngitis is that type of laryngitis that occurs after exposure in one who is of the gouty or rheumatic diathesis. It differs only from the simple acute laryngitis in that the predisposing cause is the presence in the circulation of irritating materials, which are being formed in excess or are not being excreted in normal quantities. In this form of laryngitis the throat soreness and pain on speaking are very intense and more pronounced than in the simple variety. The throat soreness is increased during deglutition, and there is marked tenderness on pressure. The voice is usually very hoarse and often aphonic. The patient is depressed, with great lassitude. There is a marked indisposition to work and to make any continuous mental effort. The patient grows extremely anxious as to his condition. There is an almost constant nervous clearing of the throat. The laryngoscopic picture shows a slightly more punctated condition of inflammation than in the simple laryngitis. There is pain on palpation over the larynx.

Laryngitis sicca acuta is a special type of laryngitis which is characterized by the peculiar tendency which the secretion has to form grayish-white or brownish crusts. The inflammation is more intense in the cordal and subcordal region. The crusts, which form on

PLATE XXIV.

FIG. 1.

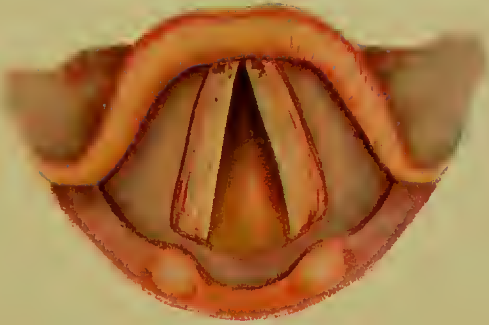


FIG. 2.

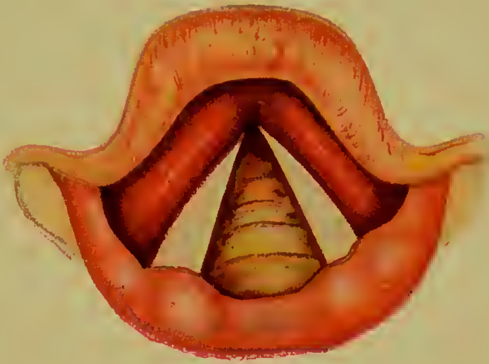


FIG. 3.

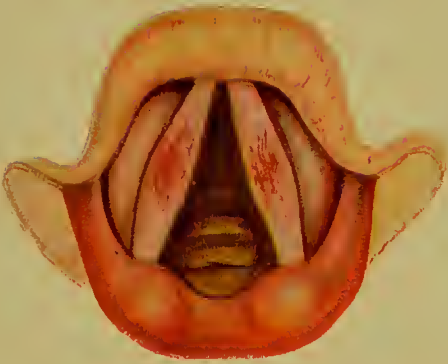
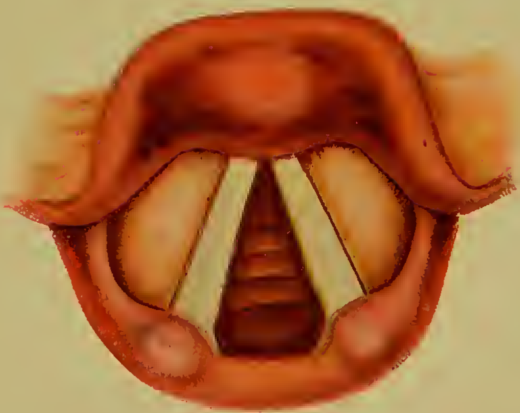


FIG. 4.



Types of Acute Catarrhal Laryngitis.

PLATE XXV.

FIG. 1.

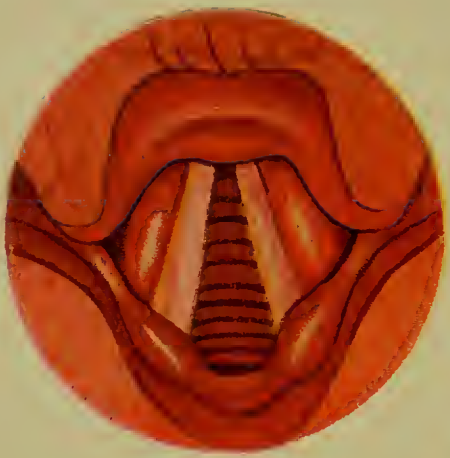


FIG. 2.

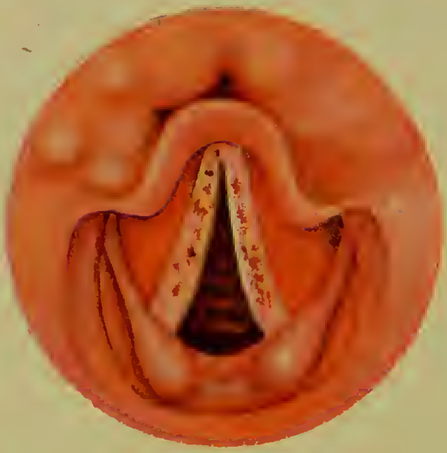


FIG. 3.

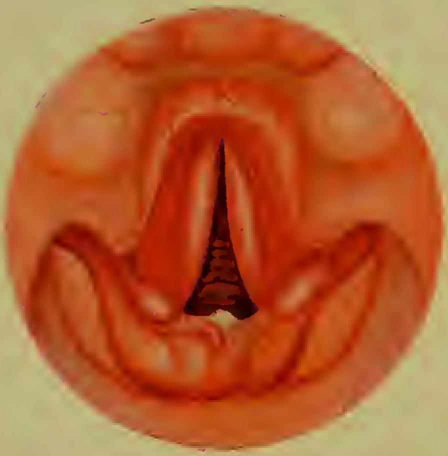


FIG. 4.

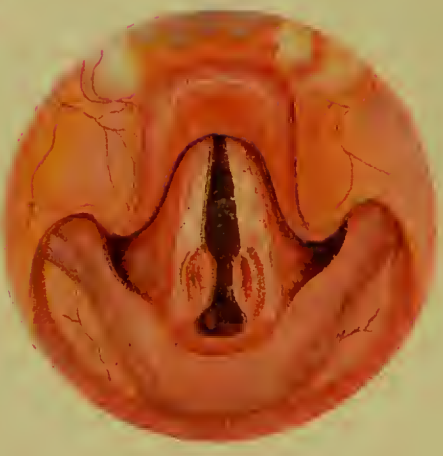


Fig. 1. Acute Catarrhal Laryngitis. Fig. 2. Hemorrhagic Laryngitis. Fig. 3. General Chronic Laryngitis with Pachydermia of the Internal Arytenoid Space. Fig. 4. Pachydermia Laryngis.

account of the deficiency in watery elements in the secretion, adhere quite firmly to the cords, interarytenoid regions, and to the subcordal portions of the larynx. The cords are usually not very markedly inflamed, although the interarytenoid and subcordal regions frequently show considerable reactive changes. The voice is usually quite aphonic when the patient awakens in the morning, becoming almost normal as the crusts are removed by rasping and coughing, to become gradually hoarser or aphonic within a few hours as the crusts reform. Coughing is very annoying, and dependent upon the amount of obstruction produced by the incrustation; the breathing may be more or less impaired. Coagula of blood may be occasionally noted in the expectoration, as well as free blood. On inspection the larynx will be observed to be slightly redder, the vocal region will be noted to be more or less covered with grayish-white or brownish crusts, and the same condition will be observed in the subcordal region. This condition is observed more frequently among females, and especially among those who suffer with atrophic changes in the nose. The condition resolves within a few days or passes into the chronic stage.

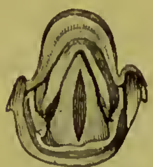
Laryngitis Hæmorrhagica. (Plate XXV., Fig. 2.) This condition can hardly be classified as an individual form of laryngitis, as I consider it simply as an incident in certain degrees of inflammation of the larynx. In the laryngitis sicca during the separation of the crust we may have a little denudation of the epithelium, with slight showing of blood or coagula. Also, in the severe types of simple laryngitis where there is localized necrosis and denudation of epithelium with the superficial reduction, we may have slight bleeding. Those laryngeal inflammations seemingly attended with marked bleeding, varying from a teaspoonful or more of free blood, are not in my opinion hemorrhages from the laryngeal mucous membrane, but rather bleeding from the pulmonary tissue. Several of such cases which I have had under careful observation have borne out my expectation by displaying at a later period unmistakable signs of pulmonary tuberculosis. Unless there is a local lesion in the larynx sufficient to account for the amount of blood lost, I should advise physical examination of the chest and bacteriological study of the sputa or blood.

Catarrhal Epiglottitis, or Angina Epiglottidea. (Plate XXIV., Fig. 4.) This variety of laryngeal inflammation is characterized by intense congestion of the epiglottis, which in severe types of inflammation occasionally shows areas of localized œdema. The difficulty and pain in swallowing in inflammation of the epiglottis is the most pronounced and distressing symptom.

We note also a profuse secretion of mucus and the sensation of the presence of a foreign body. The voice is only a little rough or quite normal. Inspection shows the epiglottis somewhat thickened and intensely congested, while frequently along its free border will be noted little areas of œdema.

Laryngitis Hypoglottica. This variety of laryngitis is happily not a very common type of laryngeal inflammation. It usually commences with the symptoms of a severe acute laryngitis, characterized by marked disturbance of the voice, severe cough, and impairment of the respiration. The interference with free respiration speedily becomes the most pronounced symptom, the breathing becoming more and more involved, the stridor being both inspiratory and expiratory. This stenosis rarely becomes so severe in simple laryngitis hypoglottica in the adult as to demand operative intervention. The cough is decidedly croupy in character. In childhood the condition is indeed a much more serious affair. The initial symptoms are the same as in the adult, although, on account of the relatively smaller calibre of the child's larynx, the symptoms of stenosis are more rapid in their development. The stenosis is characterized by laryngeal stridor which is both inspiratory and expiratory, by intense dyspnœa, marked cyanosis, and extreme anxiety. The pulse becomes rapid and thready and the whole appearance is that of a child with laryngeal diphtheria. The stenosis is followed after a time by gradual relaxation and recovery, or becoming more intense, unless relieved by tracheotomy or intubation, terminates in death through asphyxia. The laryngoscopic investigation of laryngitis hypoglottica shows the upper and middle regions of the larynx entirely free or only moderately inflamed, while the vocal cords may be moderately injected or show no change.

FIG. 416.



Laryngitis hypertrophica acuta in a child five years old.

It is entirely in the subcordal region of the larynx that the pathological changes are noted. Upon deep respiration two deeply congested immobile swellings will be noted just below the vocal bands, nearly filling up the lumen of the larynx. From the subjective symptoms alone it is extremely difficult to differentiate the condition from laryngeal œdema, laryngeal diphtheria, and other conditions giving rise to stenosis. In the adult the differentiation from perichondritis and œdema is somewhat difficult. In children, where the laryngoscopic picture is difficult to obtain, the differentiation between diphtheria and hypoglottic inflammation is at times extremely difficult. The differentiation can only be made positive through the laryngeal mirror showing the characteristic hypoglottic swelling or the false membrane and the results of bacteriological examination. I have long since been of the opinion that in many of those cases in children wherein we have apparently laryngeal diphtheria, and in which cultures show the non-existence of the Klebs-Loeffler bacillus we have this condition present.

Acute Laryngitis in Childhood. Pseudocroup. In children where the inflammation involves only the supracordal portion of the larynx, we have a train of symptoms identical with those that occur in the adult with the same disease. There is hoarseness of the voice, a high, metallic, laryngeal cough, and a slight stridor in breathing at night. At other times, and always in children of a strumous type, the laryngeal affection assumes a more serious phase and is characterized by nocturnal paroxysms of intense dyspnœa. In this form, which is commonly designated as false croup, the child during the first day or so may manifest the usual symptoms of a cold with slight hoarseness, a metallic cough, and a mild febrile disturbance. They display during the day their usual brightness of spirit, showing no premonition of the impending disturbance which may occur during the night. On the first or second night after first displaying an irritation of the upper air-tract the attack of paroxysmal difficult breathing manifests itself. After a quiet sleep varying from one to several hours, the little one's respiration will become audible with a slight respiratory stridor. After this condition lasts for a few moments the child becomes restless and is at last awakened by the intense desire for air, with a high-pitched respiratory stridor. The breathing becomes exceedingly embarrassed, the stridor more marked, the cough sharp and shrill, the face anxious and cyanosed, the pulse rapid, and the face and head bedewed with perspiration. After a few moments the paroxysm relaxes slightly, the breathing becomes easier, though still audible, and the voice clearer. In from fifteen minutes to an hour the relaxation is complete and the little one falls into a quiet slumber which may continue until morning, or from which it may be aroused by another paroxysm. During the succeeding day the condition is about the same as the day preceding the paroxysms, although the patient is usually "droopy," somewhat hoarser, and the cough more frequent. Paroxysms may occur on the second or third night, or the attack may resolve after the first or second nocturnal paroxysm. The laryngeal picture in pseudocroup is difficult to obtain at the time or immediately after the paroxysm of difficult breathing, on account of the tender age of the patient. Störk, Moldenhaur, Dehio, Rauchfuss, Krieg, and Rosenberg claim that the disturbance is due to a subcordal swelling of the mucous membrane of the larynx, practically a laryngitis hypoglottica acuta. Gottstein, Schroetter, Jurasz, and Schech state that while there may be a slight infiltration of the mucosa they cannot believe that this condition is attended with the swelling which is present in laryngitis hypoglottica. The last mentioned observers believe the nocturnal paroxysms to be spastic in character, excited through irritation from dried secretion. This condition can be differentiated from laryngeal diphtheria by mild subjective symptoms, by the amelioration of the symptoms during the daytime, by the peculiar nocturnal paroxysms, and by the history of previous attacks, while in diphtheria we have the persistence of the symptoms with a progressive increase in their severity rather than amelioration, by the prostration, and through the laryngeal examinations and culture results.

The diagnosis of laryngitis can be frequently made without any difficulty through the objective and subjective symptoms presented by the patient, but the seat and character of the inflammation can only be determined through inspection by means of the laryngoscope.

At times one will find it extremely difficult to examine the larynges of little ones; but care and patience will often enable us to accomplish wonders even with them.

Prognosis. The simple acute laryngitis usually gives a most favorable prognosis. Under proper treatment and care all cases should resolve. Many cases, even without medical attention, within a few days or a week make a complete return to the normal. The laryngitis hypoglottica gives rise to grave anxiety, and in children it may be attended with fatal issue. Due care must be exercised in treating these conditions to see that the resolution is complete, otherwise they lapse into a chronic state.

Treatment. Prophylaxis in regard to proper care of the skin, bathing, and unnecessary protection to the neck, should be thoroughly instilled into patients. Constitutional treatment as directed in acute coryza is often efficacious in breaking or lessening the severity of an acute laryngitis. Rest for the voice is absolutely essential, and should be insisted upon when the voice is at all changed. When the cough is annoying it can be allayed by the administration of codeia in 0.03 doses, or heroin in 0.01 doses every four or six hours. Often administration of one-drop doses of tincture of aconite for every half-hour until six doses are taken have an exceedingly beneficial result. Where there is excessive irritability from dryness of the larynx the 0.01 grain tablet of pilocarpine acts very well. Rest in bed, even in the milder cases, brings about a quicker resolution, and in the more severe cases is to be insisted upon. The bowels should be kept well open. Cold compresses to the neck should be employed when much soreness and discomfort are present. When there is congestion and swelling of the epiglottis and arytenoids and aryepiglottidean folds the ingestion of milk as hot as can be borne gives great relief. Instead of cold applications, counter-irritation in the form of mustard pastes or tincture of iodine applied from the upper border of the larynx to the middle of the sternum gives great relief. The diet of the patient is to be regulated; it is wise to put them on a limited liquid diet. The temperature of the room should be kept at a medium of about 70° F., and it is well to keep the atmosphere moist by the generation of steam, especially during the early stages of the inflammation. The desired effect of steam can also be accomplished by the inhalation of compound tincture of benzoin, of which a teaspoonful is added to a pint of boiling water. The use of oily solutions and the insufflation of powders in the larynx are thoroughly bad, and I am sure do more harm than good. If there is evident constitutional disturbance present, which may have some influence on the production and maintenance of the laryngitis, it should be actively treated. Therefore rheumatic and gouty conditions, gastro-intestinal disturbances, syphilis, acute exanthemata, diseases of the heart, etc., should be appropriately looked after. Whenever the laryngitis is due to irritation from dust, chemicals, etc., the patient should be removed absolutely from these sources of irritation. Local treatment forms an essential feature in the relief and restoration of many cases of laryngitis. At present there is a difference of opinion as to the best and most non-irritating method of making these topical applications. Some use them through the medium of the spray, others with a syringe, and still others by means of the laryngeal applicator. When one possesses the necessary skill and the extreme nicety of manipulation to make application with exactness and gentleness of touch, there is no question of the superiority of direct topical applications over the spray or the syringe. In the early stages of acute active congestion, œdema, or hypoglottic infiltration the use of a few drops of the solution of suprarenal extract or the adrenalin, repeated once or twice daily, lessens greatly the œdema, swelling, and congestion of the mucous membrane. The use of alkaline sprays to the nose, pharynx, and larynx should not be overlooked, and whenever there is obstructive disease of the nasal chambers present appropriate treatment should be instituted to relieve it. Topical application should not be resorted to until secretion is established. The local application of the mineral salts is especially efficacious in bringing about resolution. The silver salts, on account of their mild astringent and germicidal action, are the most favored lately, especially protargol. The sulphate and chloride of zinc are also used to meet the same indications in 1 to 3 per cent. solutions. I prefer the silver salts in a 1 per cent. solution, or the protargol in 1 per cent. solution applied every day. Where dysphonia is a very distressing symptom, especially if the patient is a public speaker, singer, or one whose vocation requires the frequent use of the voice, I find that resolution is materially aided by the use of the continuous current applied to the larynx. In the acute laryngitis of children care should be exercised in proper clothing, bathing, regulation of the diet, and building up of the general health. These children usually flourish under the administration of iron, arsenic, and cod-liver oil. When acute attacks occur the child should be kept in a well-warmed room in which steam is admitted or lime is allowed to slack. It should be given a calomel purge in small divided doses. Internally it should be given one-quarter drop doses of aconite with a stimulant expectorant every two hours, as:

Ammoniæ bromidi,		1.00
Ammoniæ carbon,		1.00
Tincturæ aconitii,		.50
Glycerinæ,		8.00
Aquæ,	ad	62.00

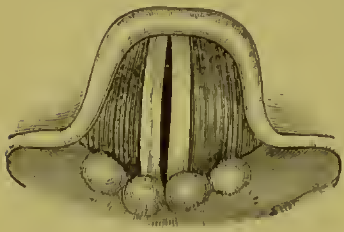
Holt recommends—

Chloral,	5.00
Potassii bromidi,	3.00
Ammoniæ bromidi,	2 00
Aquæ cinnamomi,	62.00

Sig.—Teaspoonful every twenty minutes until improvement takes place.

External applications in the form of stimulant embrocations applied to the chest and neck act very well. I prefer the official soap liniment for this purpose. When the paroxysm of difficult breathing is coming on, as indicated by the stridulous breathing, if the little one is awakened and given draughts of warm milk the attacks will be considerably ameliorated if not broken up. Should stenosis be very intense it may be necessary to resort to intubation. In laryngitis hypoglottica the general plan of treatment as outlined above should be carried out. In this case the adrenalin, external application of cold, and depletion by the bowels are especially efficacious. The use of a spray of a 1 per cent. solution of chloride of zinc or of a 2 per cent. solution of protargol is exceedingly beneficial, especially when taken in with deep inspirations. Should breathing become markedly embarrassed it will be necessary to resort to tracheotomy or intubation. Local application in rheumatic laryngitis is not advisable.

FIG. 417.



Faulty approximation of the vocal cords as often observed in chronic hypertrophic laryngitis. (COAKLEY.)

Chronic Laryngitis. Chronic laryngitis is a chronic inflammation of the mucous membrane characterized by alteration in the voice and the secretion.

Etiology. There is no doubt that the larger proportion of cases of chronic laryngitis are due to frequent neglected attacks of acute laryngitis which, through the imperfect restoration to the normal condition, leave after each attack a certain amount of residual congestion and inflammation which, added to by recurring attacks, terminates in pronounced permanent changes in the form of congestive hyperplasia or hypertrophy. Obstructive diseases of the nasal chambers, causing mouth-breathing, chronic nasal catarrh, diseases of the nasal sinuses, and chronic changes within the nasopharynx are all productive of chronic laryngeal changes. There is no doubt that changes within the faucial as well as in the lingual tonsillar tissues act as exciting causes. Ofttimes inflammation and enlargement of the uvula are secondary to chronic changes in the pharynx or larynx, nevertheless there are times when the engorgement and enlargement of the uvula precedes the laryngitis, and its removal aids materially in bringing about resolution. The persistent and continuous misuse of the voice, and the effort to produce artificially a singing voice of greater range than the individual possesses, is frequently followed by chronic laryngeal changes. This is observed in preachers, public speakers, street criers, singers, actors, and indiscreet young people who think they possess voices of great merit. Persistent and continuous exposure to an atmosphere which is deleterious, as working in rooms surcharged with steam, dust, lime, or human emanations, excessive use of the voice in overheated rooms, and injurious habits, as the addiction to the excessive use of condiments, alcohol, and tobacco, are all conducive to the production of chronic laryngeal inflammation. Most of the acute infectious diseases are attended with more or less laryngeal involvement which, if not brought to resolution, may pass into the chronic state; the chronic infectious diseases, such as tuberculosis and syphilis, are almost always attended with chronic laryngeal inflammations. I consider it wise in all chronic laryngeal inflammations to examine carefully for tuberculosis and syphilis. Diabetes, gout, and the lithæmic conditions coexist with and apparently influence the changes which go to make up chronic laryngitis. Epidemic influenza, from its marked proneness to affect the upper air-tract, especially the larynx, can be considered an active factor in causing chronic laryngitis.

Symptoms. Ordinarily those affected with chronic laryngitis do not complain much of the subjective sensations. There may be noted a slight dryness or a feeling as though something foreign were in the larynx causing the patient to make frequent and more or less violent attempts to clear the throat; occasionally there is dysphagia. In some individuals the frequent clearing of the throat, known as "hemming," is often so continuous and frequent as to become distressing and nerve-destroying to those forced to associate with one so affected. It is the alteration and impairment of the voice that are most distressing to the patient. The voice varies greatly in different cases as to the amount of change present. In some cases it is only slightly altered from time to time, in others very hoarse, and still again it may be entirely aphonic. The voice may be clear on arising in the morning, to become hoarse as it is subject to more use; or the reverse may be the case, that is, the patient awakens very hoarse to find that within a short time the voice becomes clear and strong. In public speakers and singers the ordinary conversational voice may show only slight alteration or no change whatever from the normal, yet when such a person attempts to address an audience, using the voice in its higher registers, he finds that the muscles quickly tire, he becomes conscious of an irritation and a tickling in the larynx, and his voice either breaks or becomes weak, hoarse, and often aphonic. The effort if persisted in is followed by more irritation, which is often attended by distressing paroxysms of coughing. In singers the alteration is noticed more decidedly than in others, as a more delicate and intricate functioning of the larynx is necessary for the production of the singing voice. At first singers notice a shortening of their register, that is, the inability to sing certain notes in the upper register which before they could strike with ease. They also note the quick tiring of the voice. If they do not take timely warning, and still persist in singing, the voice becomes hoarse after short efforts, breaks, and many notes in the register become weaker. The attempt to force the muscular structures under unfavorable conditions leads to a feeling of soreness or even actual pain in the larynx. The degree of hoarseness is dependent upon either the amount of infiltration of the vocal cords, the false bands, the swelling in the arytenoid region, the degree of paresis, or the amount of secretion. Cough is not an essential feature of chronic laryngitis, usually only being present when, through exertion, there is excited an irritation in the larynx. The amount of secretion varies greatly. It is usually moderate and is thrown out in little pearl-like masses or shred-like strands of clear mucus. Laryngoscopic inspection shows the laryngeal mucous surface swollen and congested. The amount of redness and swelling is subject to great variation. The redness may be as intense as is often observed in the most acute forms of acute laryngitis, a saturated red, seldom, however, involving the whole mucous surface. Most frequently it varies from a delicate rose tint to a dirty grayish-red. At times the mucosa shows a dark bluish-red appearance, with enlargement of the veins. The false cords, the mucous membrane over the arytenoids, and the subglottic region frequently show the most marked congestive changes, as is evidenced by the marked redness of these parts. The vocal bands show most frequently a slight off-coloring, a slight pinkish-gray discoloration, again a want of lustre, with the showing of several transverse markings of minute capillaries, and still again a bright-red slight linear injection along the free border of the cords. There is usually more or less swelling of the mucous membrane dependent upon the activity as well as the duration of the chronic laryngitis. In acute laryngitis there is only a round-celled infiltration, whereas in chronic laryngitis this condition has passed to one of actual hypertrophy. This hypertrophy may expend its force on one of the layers, or may affect all the layers of the mucosa. The epiglottis is frequently thickened, stiff, and almost immobile, while tortuous veins are noted toward its base. On account of this immobility of the epiglottis it is at times difficult to obtain an inspection of the interior of the larynx. The aryepiglottidean folds and the false cords are prone to hypertrophic changes. The swollen false bands frequently extend to the middle line, coming in contact during phonation at the anterior third or throughout their whole length, thus obscuring completely the true cords. In case of only a partial covering of the true bands we have only a dampening of the voice. When the cords are entirely covered by the false bands extending completely to the middle line, they may either interfere with the function of the voice by preventing the cords coming into apposition, or may take the place of the true cords and functionate for them, producing a raw hoarse voice. The most frequent changes are observed, however, in the region of the arytenoid, either along the anterior portion or in the interarytenoid space. The redness and swelling over the arytenoids and the posterior wall are always pronounced. The normal delicate outline of the arytenoid is lost in the infiltration which takes place in the mucous membrane over the cartilage. The processus vocalis and immediately neighboring portions of the vocal bands are congested and somewhat thickened, while the interarytenoid region is not only congested, but thrown into irregular folds, indicating a piling up of epithelial cells if not an actual hypertrophy of the papillary and submucous layers. These alterations are at first characterized by a tired sensation in the throat, with slight hoarseness on speaking. Slight desquamation of the epithelium here and there on the mucous surface gives rise to catarrhal ulcers which usually heal kindly with or without treatment. The amount of secretion is slightly in excess of the normal, and may be thin, fluid-like in character, or show a tendency to form in crusts, adhering to the surface of the cord or mucosa in the subcordal portion of the larynx. On observation the mucus is seen in little bead-like formations adhering to the upper surface and to the free edges of the cords, simulating very closely singers' nodes, while at other times it shows in very fine strand-like forms running from one band to the other. Paresis of the vocal bands is very common in chronic laryngitis, showing itself most frequently in the thyro-arytenoidei interni and the transversus.

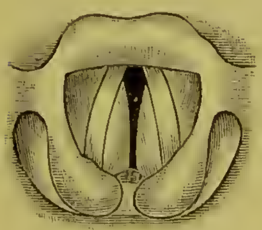
The **diagnosis** is made through the examination with the laryngoscope, and this, with the usual subjective and characteristic local changes, should offer no obstacle to its recognition. Marked congestion of one or both vocal bands, or considerable thickening of the same, should arouse the suspicion of possible constitutional disturbances, as of tuberculosis or syphilis. Marked thickening in the interarytenoid region or about the processus vocalis may warrant the diagnosis of pachydermia. In making a diagnosis care should be exercised in carefully examining the nose, nasopharynx, pharynx, and lungs in order to show the possible corelationship between diseased conditions in these parts, if found, and the laryngitis.

Prognosis. The condition under consideration is under ordinary circumstances not fraught with much danger to the average individual so far as his longevity is concerned. Laryngitis of this type may exist for years without showing much alteration, except that due to occasional acute exacerbations. For those whose vocations are dependent on the use of the voice, this condition is indeed a serious problem and its relief essential. Ordinarily a thorough appreciation of the factors entering into its etiology, their removal, and a careful meeting of indications will usually bring about a complete resolution. The course of treatment is frequently a prolonged one.

Treatment. First of all, a thorough appreciation of the possible etiological factors must be taken into consideration, and means undertaken to remove these must be instituted at once. If there is disease of the nose or nasopharynx, such as hypertrophies, disease of the sinuses, deflected septum, adenoids, diseased tonsils, or enlarged uvula treatment should be adopted to restore these parts to the normal. Constitutional conditions which may have an influence in maintaining the laryngitis should be corrected, and habits that may prejudice improvement should be broken up. Ofttimes a change of climate from the seashore to the mountains or from the mountains to the seashore works great benefit. A few months spent at one of the well-conducted sulphur springs where a rigid regimen is carried out often produces extreme benefit. Great care should be exercised in the use of the voice. Singers, actors, and public speakers should be counselled to abstain from the use of the voice in singing or in loud speaking. It is much better if these individuals use the voice as little as possible, and then in a whisper. Local treatments are of value only in that they supplement and assist the restoration to the normal after the removal of the cause. The medicament may be applied through the medium of the syringe, the spray, or by a cotton covered applicator. Unless one possesses the necessary manipulative dexterity to make the laryngeal application gently and accurately, it is much better for the operator and the patient to make use of the spray or the syringe. When wishing to reach the supraglottic regions in the use of the spray or atomizer it is best for the patient to have the tongue held out well and at the same time to sound a high note. If it is desirable to reach the subcordal region the tongue should be held well forward while the patient makes deep inspirations at each time the spray or solution is injected. The mineral astringents are far preferable for local use to the vegetable. I have no hesitancy in deprecating the use of powders in any form in the larynx. The mineral astringents should be used in aqueous solution, and these preferably at a temperature of about 100° F. In most text-books the astringents are recommended in too strong a solution. Even a 1 per cent. solution of silver often causes considerable smarting that may last for hours. The astringent applications or solutions for spraying that I prefer are: protargol, 1 per cent. solution; argenti nitratis, 1 to 2 per cent. solution; zinci chloridi, 0.5 to 1 per cent. solution; zinc sulphate, 1 to 3 per cent. solution. The above solutions should be used no more frequently than every other day, and one may be interchanged for the other from time to time during the treatment. It will also be noted that as the case progresses it will be necessary to increase the strength of the particular drug which is being used. Whenever there is considerable induration and thickening of tissues against which there is desired more intense action, I prefer either the use of pure crystals of chromic acid or the galvanocautery burner.

Laryngitis Hypoglottica Chronica. This form of laryngitis is characterized by an infiltration of the mucosa and submucosa of the subcordal portion of the larynx. Laryngitis hypoglottica is not a very common affection. It seems to be more prevalent in Continental Europe, and especially among the natives of eastern and southeastern Europe.

FIG. 418.



Etiology. It is said to be due to exposure to cold and to follow severe types of chronic laryngitis, and from unresolved acute hypoglottic infiltrations. It is more frequently secondary to constitutional affections. It is sometimes a sequela of typhoid fever; it may be secondary to pulmonary tuberculosis, or a local manifestation of syphilis, scrofula, and rhinoscleroma.

Symptoms. The thickening and rigidity of the epiglottis which frequently coexist with subglottic swelling ofttimes makes examination of the larynx extremely difficult. The voice is always altered, markedly hoarse, or complete aphonia exists. The most marked symptom is the difficulty in breathing. The interference is at first only noticeable when moving about and making exertion; later it becomes more intense, so that it is pronounced even when at rest, and is attended with both an inspiratory and an expiratory stridor. At night the breathing is frequently markedly impaired, and when tough secretion collects there may be paroxysms of extreme distress; as time passes the obstruction becomes greater and the stenosis more pronounced. On inspection just below the vocal bands two reddish or pinkish masses extending inward and obstructing the calibre of the larynx are observed. These masses may nearly meet in the middle line, allowing only a very small space through which air gains access to the lungs, or they may show somewhat of a cleft, especially at the posterior border. The mobility of the vocal bands is usually impaired Cough is present, and is frequently of an extremely distressing type.

Diagnosis. The diagnosis is not usually difficult. The characteristic picture seen in the laryngoscope is almost pathognomonic. It must be differentiated from perichondritis or abscess, from both of which it can be diagnosed by the denseness of the hypoglottic swelling, the freedom from high fever, and the absence of tenderness on external pressure.

The **prognosis** is uncertain both as to restoration of function and as to life. Very frequently the case terminates fatally unless operative intervention is carried out. Three of such cases, under my care, that refused the benefit of operative relief died from suffocation. Those of the tubercular type are the most serious, those due to exposure and syphilis are the most favorable.

Treatment. Internal treatment should be administered along the line of the constitutional condition which seems to be the etiological factor. In doubtful cases it seems to be prudent to administer the iodide of potash. Those who have had great experience in treating this condition advise, when the embarrassment to breathing is not great, the local application of silver in caustic solution, scarification, and the application of the galvanocautery. I would be extremely cautious in advising the use of the two latter. The course I have usually pursued and which is advised by Sokolowski is the early performance of tracheotomy, laryngofissure, and excision of as much of the hypertrophied tissue as possible. After the healing of the laryngofissure Schroetter's bougies are used, or, as I prefer, the intubation tube, until the space is sufficiently dilated to permit dispensing with the tracheotomy tube. After the tracheal tube is removed it becomes necessary to occasionally introduce the bougies or intubation tube throughout quite a long period.

Chronic Dry Laryngitis. This is a form of chronic laryngitis, also called laryngitis sicca, which is characterized by a secretion deficient in water elements, which secretion tends to adhere to the mucosa and form crusts.

Etiology. This form of laryngitis frequently ensues after a neglected attack of acute laryngitis sicca. It is more frequently the result of the extension of the atrophic form of nasal catarrh and atrophic pharyngitis. The involvement of the larynx is not always a necessary sequence of the advanced form of atrophic rhinitis, for we frequently find very old atrophic cases, with marked destruction of the soft tissues in the nose without change of any character in the larynx. Nor is the laryngitis sicca always due to a direct extension by continuity of surface, although this method is no doubt a frequent method of its extension, for it may be due to the circulatory changes produced by the mechanical irritation of an atmosphere which is thoroughly unfit for laryngeal respiration—*i. e.*, an atmosphere chilled and deficient in moisture. Radical operative work in the nasal chambers, as complete turbinectomies, results in producing this condition. I have seen the most exquisite cases of laryngitis sicca produced in this way. The condition excited is a change in the mucosa and the submucosa, with atrophy of the glandular layer leading to the production of an altered secretion, from which the moisture is further reduced by the inspired air.

Symptoms. The accumulation of secretion takes place in these cases chiefly while the larynx is not being used and when the patient is at rest. On awakening in the morning the larynx is usually quite choked up with crusts, which become loosened with the restoration of secretion. This usually takes place with the performance of the toilet and the exercise incident thereto. At first the patient is quite aphonic, and there may be paroxysms of laryngeal spasm on account of the separating crusts being caught between and irritating the vocal bands. As the crusts are removed the voice becomes clearer and may become almost free from hoarseness, to remain so throughout the day, or become hoarse again after a few hours, due to fresh crust formation, clearing up again with the coughing out of the freshly formed crusts. In other cases the voice remains of alternating degrees of hoarseness and aphonia throughout the day, depending upon the freedom from crusts in the larynx. Coughing is a very persistent symptom, and is usually very distressing at night. Violent clearing of the throat at periodic intervals is also present. At night these patients are frequently aroused by an embarrassed respiration and occasionally by paroxysmal suffocative attacks. The secretions resemble very much those produced in atrophic changes in the nose and pharynx, and are occasionally streaked with blood.

Examination of the larynx reveals a slightly congested or anæmic larynx, having a peculiar glazed appearance, with grayish-white crusts adhering to the interarytenoid region, to the vocal bands, and the subcordal region.

The **prognosis** is not very favorable to a restitution to the normal. At times great improvement may be gained and great comfort to the patient afforded.

Treatment. The same line of treatment in a constitutional way should be instituted as I have directed in atrophic rhinitis: the administration of tonics, iron, arsenic, strychnine, and cod-liver oil; the proper care of the skin, bathing and clothing; terpin hydrate, for its seemingly specific action on the mucous surface, should be administered in 0.02 to 0.06 doses. The local treatment of the nose and pharynx when diseased should not be neglected. It is strongly advised before adopting any local treatment to thoroughly cleanse the laryngeal mucous surface of all crusts and secretions by spraying with an alkaline aseptic solution. As a slightly stimulant solution answering the same purpose one may use a solution of sulpho-carbolate of zinc, 0.30 to the litre of water. I wish here again to protest against the use of mentholated oily sprays in this type of inflammation. The only solutions that can be of value are those that will act as active stimulants to the laryngeal mucosa, through which we hope to stimulate the activity of degenerated glands. Chief among the agents which we use for this purpose are chloride of zinc, silver nitrate, and protargol in strengths varying from 1 to 3 per cent.

Pachydermia Laryngis. (Plate XXV., Figs. 3, 4; also Figs. 419, 420.) Pachydermia laryngis is a chronic inflammation of the laryngeal mucous membrane which may involve any portion of the larynx, but is especially prone to affect those portions covered normally with flat epithelium. It consists essentially in a proliferation of the epithelial and papillary layers. Virchow ably described this condition in 1887, and thereby aroused the interest of the laryngological world in its existence. Pachydermia had frequently been observed by laryngologists before this, but had not received the attention and careful description that it did during the year 1887.

Etiology. There appears to be a universal acceptance of the idea that pachydermia is most frequently the result of chronic laryngitis, the overindulgence of spirituous drinks, and the excessive use of tobacco. Schmidt seems to think that atrophic rhinitis and pharyngitis are factors through the cough and persistent clearing of the throat excited by this condition. Among constitutional conditions may be mentioned tuberculosis and syphilis. This condition is more prevalent among men than women, and is more frequent during young adult life. The infiltration may be found upon any portion of the larynx where normally flat epithelial cells are present. It is found most frequently about the arytenoid region, that is, in the interarytenoid space, or on the inner surface of the arytenoid cartilages, and upon the processus vocalis. The pachydermia is usually flat, and may be more or less diffuse or circumscribed.

Symptoms. The symptoms which are excited by the presence of pachydermia vary greatly. The interference with normal function consists in alteration of the voice, difficulty of breathing and swallowing. The functions are affected in greater or less degree, according to the location of the infiltration. Where the growth is on the processus vocalis or on the posterior wall there may be marked hoarseness to complete aphonia. At other times, with pronounced growth on the inner wall of the arytenoid, on account of the depression formed in one of the two growths, there may be only a very moderate change in the voice. Frequently patients complain of a feeling of fulness and of more or less stiffness in deglutition. The amount of difficulty in breathing depends upon the degree of interarytenoid infiltration and fixation of the vocal bands.

On inspection the appearance will vary according to the region of the larynx affected. In its milder forms pachydermia shows itself in a slight, irregular bluish or grayish-white wavy-like elevation of the mucous membrane in the interarytenoid region. The epithelial layer seems to be most affected in this type. The same milk-white or bluish-white lustreless thickening of the epithelial layer may be observed also over the processus vocalis. In this latter type the swelling over the vocal processes may show marked increase in growth in every direction, even extending on to the true cord, forming a growth from 1 to 2 mm. in length to 0.5 to 1 mm. in width. With this increase in size one or the other of the growths shows a depression on its surface, into which the prominence of the other fits more or less exactly. In the arytenoid region ofttimes the infiltration is very great, forming prominent round or irregularly outlined elevations with intervening clefts which look like fissures; these are covered with hard epithelium which has a snow-white, a grayish-white, or a yellowish appearance.

FIG. 419.

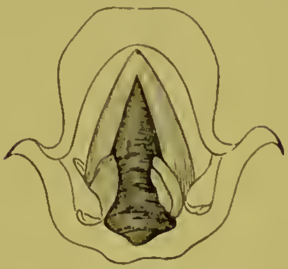


FIG. 420.

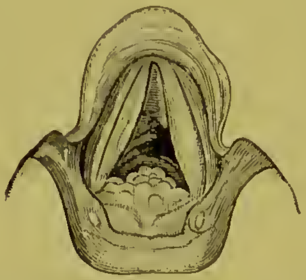


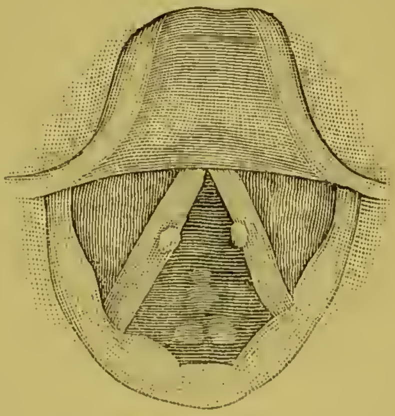
FIG. 419.—Pachydermia laryngis affecting inner surface of arytenoids and processus vocalis.
FIG. 420.—Pachydermia laryngis of the interarytenoid region.

Diagnosis. The diagnosis of pachydermia is readily made from the characteristic find of the laryngoscope. The presence of the thickening over the processus vocalis or both vocal cords, one of which shows the peculiar indentation or the round, irregular, grayish-white swelling on the posterior wall, causes one to think almost immediately of pachydermia. It is differentiated from papilloma by the fact that papillomata are always superficial. The papilloma is very feebly attached, growing only from the epithelial surface, while the diffuse pachydermia is very firmly attached, and requires the use of cutting forceps to detach it. The papillomata also have the characteristics of new-growths, while pachydermia have the appearance of inflammatory swellings. When pachydermia affects the cords anterior to the processus vocalis or the ventricle of Morgagni it is extremely difficult, if not almost impossible, to differentiate it from cancer, and liability to error is not entirely avoided by microscopic examination of a portion of the removed growth.

The **prognosis** is in the mild type of cases a favorable one. Those due to simple irritation and to conditions that can be removed offer a very favorable prognosis. Cases after a shorter or longer period of existence occasionally spontaneously heal. Such a spontaneous resolution is also occasionally seen in pachydermia due to tubercular infection, as a result of the marked improvement in the general condition. The duration of the condition, however, is usually a prolonged one, extending over a period of sometimes many years. With a due consideration of the causative elements and the proper institution of appropriate treatment good results can be brought about in a fair proportion of cases, and in many the arrest of further extension of the proliferation.

Treatment. For all types of the pachydermia the treatment should be directed to the removal of the cause, systemic and local sources of irritation, and the improvement of the general health. Many advise the administration of the iodide of potash in small doses. There should be restriction placed upon the use of the voice. The local treatment of any coexisting disease of the nose or pharynx should receive most thorough attention, as well as the chronic inflammation of the larynx. This is all that is necessary in the majority of mild cases presenting themselves for treatment. Locally in the more pronounced cases of infiltration it is wise to make local applications of silver nitrate in 1 to 4 per cent. solution, or of salicylic acid in 20 per cent. solution of alcohol. The galvanocautery can be used as well as electrolysis in a strength of 10 to 12 milliampères applied for three to five minutes. If the growths are pronounced on the inner surface of the arytenoid and are causing marked alteration of the voice, it is well to resort to the use of cutting forceps, as through them the growth can be removed quickly and leave a clean, healthy wound.

FIG. 421.



Singers' nodes

Singers' Nodes or Chorditis Nodosa. A singer's nodule is an inflammatory growth situated on the free edge of the vocal cord at the junction of the anterior and middle third. These growths may be single, but are more frequently multiple, being situated on vocal cords located identically opposite each other. This condition is classed by some authors with pachydermia, but they are entirely dissimilar in origin as well as in pathological organization.

Etiology. The nodule is more frequent in young adult life. It is found more often in the female sex, and is far more common among those who sing or who are cultivating their voices. The most common cause for the existence of the nodule is the improper use of the voice either in speaking or singing. It is in the production of the tone that the injury is done, that is, the stroke or impact is imperfectly placed, so that attrition between the segments of the cords is possible. The attrition so produced sets up an inflammatory irritation which results in the production of the nodules. The greatest injury is done in the use of the upper middle register. The condition is said to arise during attacks of acute and chronic laryngitis, and from vocal fatigue.

Symptoms. The nodule is usually characterized by more or less hoarseness of the spoken voice, the degree of the hoarseness depending upon the situation and the development of the growth. The voice breaks readily, and singers are unable to fix the tone or sing with any degree of certainty as to pitch or resonance. The patient is unable to carry out any prolonged effort on account of the great laryngeal fatigue and pain entailed. They often present even marked hoarseness of the spoken voice. The diagnosis can only be rendered clear by an examination of the vocal cords. The singer's nodes are very characteristic and should not be mistaken for any other condition. They are situated at the junction of the anterior and middle third of the vocal cords, and appear as small intensely white or yellowish pin-like points on the free border of the vocal cords. They are about the size of a pin's head, sessile, opaque, and usually symmetrical bodies placed one on each vocal cord. As the nodes come in apposition they cause a slight cleft between the cords.

Diagnosis. The diagnosis is readily made from the subjective symptoms and the laryngeal examination. It is possible for a couple of beads of mucus vibrating on the vocal bands to be mistaken for vocal nodes. The differentiation can always be made by causing the patient to clear the voice, which removes the mucus.

The **prognosis** is usually favorable.

Treatment. The most important feature in the restoration to the normal condition in chorditis nodosa is the correction of the method of singing. Most singers so affected are those given to the clavicular method of breathing. These should be taught the inferior costal method of breathing with fixed high chest. They should be placed in the hands of a good singing-master who can instruct them in the proper method of tone placing. Complete rest from singing other than instructions given should be insisted upon. This method will usually in a short time bring about complete resolution. Many authors advise the use of a 2 per cent. solution of silver nitrate, while others favor stronger solution. It is also advised to cauterize the nodes with solid nitrate of silver, chromic acid, and the galvanocautery. Others advise the removal of the nodes with cutting forceps.

CHAPTER XIX.

DIPHTHERIA OF NOSE AND THROAT; INTUBATION; SYPHILIS, TUBERCULOSIS, LUPUS AND LEPROSY OF NOSE AND THROAT; CHRONIC LARYNGEAL STENOSIS; FOREIGN BODIES IN NOSE AND THROAT; RHINOLITHS.

By WILLIAM KELLY SIMPSON, M.D.

DIPHTHERIA OF THE NOSE AND THROAT.

Diphtheria is an acute infectious and contagious disease, occurring either endemically or epidemically, characterized by a fibrinous exudation on any mucous surface of the body or wound, being dependent for its cause on the absorption of the toxins produced by the Klebs-Loeffler bacillus. The parts most frequently affected are the cavity of the pharynx, and less frequently the larynx, nose, nasopharynx, and conjunctivæ.

No age is exempt, although it is most particularly a disease of childhood. When the larynx is involved there is a decided tendency toward extension to the bronchi.

The lesion, viz.: the diphtheritic exudate, is the same in characteristics, both in the nose and the throat; and in a general way we may consider them together. The systemic symptoms are also about the same. Occurring as they typically do in children, there are one to two days wherein they are slightly ill, gradually becoming worse, with a rise of temperature and acceleration of pulse and general prostration, until they show a localization of the membrane in either the nose or the throat.

The Nasal Type. The initial symptoms in the nose are generally those of a severe coryza, existing for a day or so, with nasal discharge, which soon becomes ichorous in character, swelling of the mucous membrane, and from the mechanical presence of the exudate very soon there supervenes a very marked nasal obstruction. As a rule, this nasal obstruction is bilateral, and from the character of the secretions the exterior of the nostrils is very liable to become acutely excoriated, indicating a more or less grave intranasal inflammation. Examination of the nose will reveal more or less of a grayish-white membrane quite well anteriorly, and often that is all that can be seen, as the intranasal obstruction prevents any deeper examination of the nose. The exudation may be evenly distributed over the entire intranasal mucous membrane, showing no special point of selection, and is practically always bilateral.

As a rule, the exudation extends well back into the nose and nasopharyngeal cavity, and if it be possible to make a posterior nasal examination we will find the nasopharyngeal cavity covered with an exudate similar to that in the anterior nares. In the more acute type of cases the child by this time becomes quite ill, with more or less glandular swelling in the cervical region. In a certain number of cases the membrane may extend to the pharynx below, and even to the larynx, presenting all the symptoms of a general diphtheria. But this is not always the case, for I am led to believe by an extensive observation that the nasal and nasopharyngeal exudation may become limited, and does not of necessity spread to the pharynx below, and we may have a purely nasal or nasopharyngeal diphtheria in a class by itself. Although, as a rule, nasal and nasopharyngeal diphtheria runs a more or less acute course, the nature of the trouble becoming very evident from the outset, there are a certain number of cases, especially where the membrane is localized in the nose, which are very slow in development, the child not becoming ill and the intranasal exudate remaining a long while in a latent condition, apparently without very much constitutional manifestation on the part of the child.

I have known of a number of instances of nasal diphtheria existing for a number of weeks without giving rise to very severe symptoms, the exudation being present in a greater or less degree the entire time, together with the Klebs-Loeffler bacilli. The severity of the constitutional symptoms seems to vary in different cases, and I have often been impressed with the mildness of the constitutional symptoms when compared with the amount of membrane which existed in the nose and the nasopharynx, which would seem to indicate in a certain proportion of cases that when limited to the nose and the nasopharynx there exists a certain immunity from absorption into the general system. This may be somewhat contrary to the general belief, but we often see it illustrated by the little patients who frequent our various clinics

Diagnosis. The diagnosis of nasal diphtheria, aside from the presence of the Klebs-Loeffler bacillus, of which we will speak later, is surmised by the finding of a membrane in the anterior nares, and in arriving at our conclusions as to the presence of the membrane we must be sure not to confound an exudation with inspissated mucus or dense mucopurulent discharge, which often exists in severe cases of coryza, and which is difficult of expulsion. The best way of arriving at a positive conclusion as to the presence of membrane in the anterior nares is, after thorough cleansing by a pledget of cotton, to try to dislodge the suspected exudate from the mucous membrane beneath, when we will find, if it be an exudate, it will be somewhat difficult to dislodge, and will leave a bleeding surface beneath; and if it be considerable in extent a quite well-marked epistaxis may be induced.

But the most positive means of diagnosis, in fact the only reliable means of determining whether the exudate be diphtheritic or not is by taking a culture, when the presence or absence of the Klebs-Loeffler bacillus will substantiate the character of the exudate.

It has been my experience in the examination of a great many cases of membrane in the nose and nasopharynx to find the Klebs-Loeffler bacillus present in by far the greater proportion of cases, however long standing they may have been, or however insignificant the symptoms, leading me to believe that nearly all cases of so-called membranous rhinitis are of a true diphtheritic nature, and should be viewed as true diphtheria, doing away with the term membranous rhinitis, which is so constantly used, and is misleading, and, also, thereby illustrating the absolute necessity of making a bacteriological examination in all cases.

Differential Diagnosis. The conditions to be confounded with nasal diphtheria are severe coryza, foreign bodies in the nose, and the sloughing of traumatisms. The first can be excluded by the absence of membrane after repeated examinations and the subsequent course of the disease. The main point of differentiation from foreign bodies, which often produce a sloughing membrane and ichorous discharge, is that foreign bodies are as a rule unilateral, whereas diphtheria is bilateral, and a mechanical examination by means of a probe will in the case of foreign bodies detect their presence. Traumatisms are to be determined by the history of their reception.

The Pharyngeal or Faucial Type. Pharyngeal diphtheria, or *diphtheria,* as we generally use the term in a generic sense, is ushered in by more or less constitutional symptoms of malaise, rather gradual in their onset, which may extend over a period of a few days before the patient makes a special reference to the throat.

The temperature in this initial stage may become quite elevated, the pulse accelerated, and as the symptoms progress it soon becomes evident that the patient is suffering from some constitutional absorption. The first symptoms as a rule referable to the throat are those of painful or difficult deglutition, when examination reveals the presence of a membrane or exudate.

The diphtheritic membrane when seen in the early stages appears in the form of a small whitish patch which may have its origin in any portion of the faucial region. It is generally thin at first, and as it progresses in extent becomes thicker and heavier in its characteristics, changing to a duller or grayer color, with sometimes a dark sloughing edge, and from a small origin may spread to cover the entire faucial area.

The spreading and rapid confluence of the membrane in the majority of cases are quite characteristic features, and as the process extends the exudate takes upon itself the appearance of an organized membrane or a true necrotic process, and if detached by any mechanical means it will be found quite adherent to the underlying tissue, leaving, as a rule, a bleeding surface.

Location of the Membrane. There is no special seat for the initial location of the membrane, but generally it makes its appearance first on the tonsil, and spreads quite rapidly to the adjacent tissues, and as a rule is bilateral. The tonsils themselves may or may not become considerably enlarged; that will depend somewhat upon their previous condition. In severe cases as the disease progresses there is generally a very strong odor, which is considered by some to be characteristic, and there is frequently associated with the faucial conditions a swelling of the adjacent lymph glands of the neck. Aside from the presence of the exudate there is also more or less marked faucial redness or hyperæmia, giving a general angry appearance.

Differential Diagnosis. The main condition to be differentiated from diphtheria is acute confluent follicular tonsillitis. The main clinical points of difference between these conditions are that in acute follicular tonsillitis the onset is more sudden, the exudate is much more friable, not a true membrane, less confluent, more punctate in character, and the tonsils usually more swollen and the exudate limited to the tonsils alone, whereas in diphtheria the characteristics are confluency and density of the exudate, and not being necessarily limited to the tonsils. It may be said in general that any exudate not limited to the tonsils may be considered as a strong point in favor of diphtheria. Sometimes we are called upon to differentiate between diphtheria and the mucous patches of secondary syphilis, and the ulceration which attends the early manifestation of tertiary syphilis, the results of caustic applications, swallowing of irritant poisons, traumatisms, and the exudate following operations within the cavity of the fauces. I am becoming more and more convinced, however, especially when differentiating from confluent follicular tonsillitis, not to rely on the clinical picture, but always to insist on making a culture, deciding the diagnosis on the presence or absence of the Klebs-Loeffler bacillus, which is the only true way of differentiation. Especially is this the more important in mild and not well-defined cases.

Laryngeal Type. The laryngeal type of diphtheria in its general onset and symptoms, when primary, is the same as in the other forms, only varying from them by the presence of the membrane in the larynx or trachea giving rise to the set of symptoms which are classified under the term of *diphtheritic croup.*

Laryngeal diphtheria may be either primary, that is, the membrane forming first either in the larynx or trachea, or it may be the result of extension of the membrane from the nose, nasopharynx, or pharynx. When the larynx is invaded, either primarily or from extension, the first symptom to attract our attention will be a slight cough which soon becomes more frequent and brassy in character, and as the membrane extends takes upon itself the well-known characteristic of a croupy cough. The *voice* and *cry* of the child, which at first may be but slightly hoarse, become as the disease extends very hoarse indeed, and almost aphonic.

In some instances where the membrane begins in the subglottic region the voice may not be interfered with to any great extent, and this is used as a point of diagnosis in the localization of the subsequent stenosis.

After the cough and change of voice have persisted for some little time there begins to be noticed an interference with the breathing. This, at first, in the majority of cases is slight, and may be only spasmodic in character, generally worse at night, and interfering with sleep; but as the stenosis progresses the breathing becomes very much more continuously embarrassed, and in bad progressive cases it ends in the well-known stridulous condition of laryngeal croup.

In severe cases, especially when from extension, and where there is much constitutional absorption, the temperature may become as high as 104° or 105°, the pulse be rapid and weak from exhaustion, and the respirations much increased in frequency, becoming as rapid as 60 to 80 per minute. In many cases, however, these extremes of temperature, pulse, and respiration are not reached.

At this stage the child becomes very restless, throwing himself about the bed in a vain endeavor to get sufficient air, calling into play the extraneous muscles of respiration, with the characteristic falling in of the clavicular and epigastric regions, and only becoming quiet as cyanosis or exhaustion supervenes.

If at this time the child be old enough to admit of a laryngoscopic examination, the epiglottis and arytenoid region will be found considerably swollen and covered more or less with membrane, which at once establishes the character of the disease. But in small children it goes without saying that we are unable to make this examination, and in cases of primary invasion of the larynx we must depend for our diagnosis upon the character of the symptoms and the presence or absence of the Klebs-Loeffler bacillus, as will be referred to later.

In all cases of nasal or pharyngeal diphtheria where *laryngeal subjective symptoms* supervene, it must be taken for granted as indicating a downward progression of the disease.

Diagnosis. The two main conditions to be differentiated from primary diphtheritic croup are acute catarrhal laryngitis with croupy symptoms, and spasmodic croup or laryngismus stridulus (false croup).

In catarrhal laryngitis the hoarseness and cough may become very marked. The cough, as a rule, does not become so croupy in character, and the breathing very rarely becomes seriously embarrassed, and there is a general tendency, either by self-limitation or by treatment, toward abatement of the symptoms.

In diphtheritic croup the main point for establishing a diagnosis other than by the presence of the bacillus is that the symptoms become *progressively* worse, and we may say that in any instance where the croupy symptoms progress to that severity sufficient to warrant surgical interference, we may be very sure that the case is one of diphtheritic croup, whether we find the bacillus or not.

In spasmodic croup or laryngismus stridulus the attack generally comes on very suddenly out of a sound sleep, and, although for the moment the croupy symptoms may become very severe, the attack is generally followed by a cessation of symptoms, and the following day the patient may be to all intents and purposes perfectly well, and there is no evidence of progressive croup. Another important point is that there is often a history of recurring attacks of croup in the child, which is frequently manifested in the course of an existing coryza.

Sequelæ. The common sequelæ of diphtheria are otitis media, from extension, suppurative adenitis, generally of the cervical glands, bronchopneumonia, nephritis, and postdiphtheritic paralysis.

This latter generally first invades the soft palate, and it may extend to a paralysis of the entire muscular system. It may come on very early in the disease, or be delayed for a variable period after the acute symptoms have disappeared. It apparently does not seem to depend upon the severity of the disease. This latter fact is quite frequently emphasized by the patient passing through a mild diphtheria, possibly unnoticed until we are made aware of it by the onset of a postdiphtheritic paralysis of the soft palate. However severe or extensive this paralysis may become, the general tendency is toward recovery, unless it affects the muscles of the heart, which may occur at any time during the progress of the disease, frequently causing sudden death.

Treatment of Diphtheria. Perhaps there is no disease which in modern times has been so revolutionized in its positiveness of diagnosis and treatment as diphtheria. This has been brought about by the discovery of the Klebs-Loeffler bacillus as a positive cause of diphtheria, and the use of the antitoxin treatment as its most effective cure. This latter statement may seem rather strong, and may possibly call forth criticism from some quarters; but I think we can safely say from the accumulated experience and writings at the present time that we have in the antitoxin treatment of diphtheria as near a specific as it is possible to obtain.

The limitations of an article such as this in a work of this kind prevent the writer from going into detail as to its substantiation, so we will have to rely upon the above statement as being the consensus of opinion of medical thought at the present time. One has only to compare his experience of results in the pre-antitoxin days with the present mode of treatment in order to emphasize the strength of the foregoing statement; and the writer considers it the absolute duty of a physician to use antitoxin in all cases of diphtheria, of whatever type or severity they may be.

The efficacy of the antitoxin treatment is best obtained when used in the early stages of diphtheria, before mixed infection with streptococci has taken place, that is, in the first three days, or even before the positive diagnosis may have been made, so as to gain time and prevent the spread of the disease. The earlier it is used, the less liable is the disease to progress, and the less likely will be the necessity for the repeated use of the antitoxin; but at any time, even when seen very late, antitoxin should be given.

The reliability of manufacture and the proper freshness of the antitoxin should be our greatest consideration in the choice of the particular serum. The strength and concentration of the antitoxin used, expressed in units, will depend somewhat on the severity of the case at the time we give it, and the age of the patient. But, generally speaking, we should err on the side of giving a large initial dose, whatever may be the age, guiding the subsequent strength of the dosage according to the progress of the case. This is especially so in laryngeal cases.

The mode of administering antitoxin is by the use of a hypodermic syringe, one generally made for the purpose, and in using it we should carry out all the details of asepsis.

The usual location for giving the antitoxin is either in the intrascapular region, the connective tissue over the abdomen, or the deep tissue of the buttocks.

We may say that the average initial dose when given in a moderately severe case of nasal or pharyngeal diphtheria, at whatever age of the patient, should be 2000 units. If the type of case be severe at the outset, or if it has progressed for two or three days or more, a larger dose should be given, beginning with 3000 units, some authorities giving even 4000 units. In laryngeal cases, either primary or extending from the fauces, at least 3000 units should be given at the outset.

Dangers of Antitoxin. In comparison to the great efficacy of antitoxin in its results in diphtheria we may say that its poisonous effects are almost nil, and they should in no way deter us from using it. In a certain number of cases arthralgia is more or less marked and a general eruption, resembling measles, makes its appearance, but it is transient. These incidents are less frequent since the more concentrated preparations of serum are being used, *i. e.*, larger number of units and smaller amount of serum. Rotch[1] quotes in 1,000,000 injections only five cases of death occurred which could in any way be attributed to the antitoxin. Also in 4500 cases in the Boston City Hospital, each receiving an average of two injections, no bad results followed, and one patient received 28,000 units and was discharged cured.

The effect of the antitoxin on the diphtheritic process is generally shown within the first twelve to twenty-four hours, and, if a sufficient dose is first given, it frequently happens in mild and early cases that no subsequent medication will be necessary, and the disease will progress to a favorable issue. The temperature falls, the pulse becomes better, and there is seen a marked absorption or exfoliation of the membrane. If the disease is severe at the time of giving the first antitoxin, and the symptoms do not abate sufficiently, the antitoxin should be repeated in a similar dose within twenty-four hours, and be repeated again in a similar or decreasing strength according to the development in the case.

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[1] Rotch, Diseases of Children.

For details as to the preparations of antitoxin serum, its various strengths, concentrations, statistics, the reader is referred to larger general works on diphtheria.

Immunity. Not only has antitoxin proven itself of such great value in the direct treatment of diphtheria, but also we have in it a strong prophylactic measure when given to those immediately exposed to the contagion. The immunizing dose should be much smaller, 500 to 1000 units, and it has been positively proven that the immunity lasts from one to three months.

Local Treatment. It is the writer's opinion that local treatment other than as an adjunct means of cleanliness and asepsis is not of such great necessity as in the pre-antitoxin days—and, indeed, in a great many instances where its administration is productive of much objection, resistance, and disturbance on the part of the patient, it can be safely dispensed with. If, however, local treatment is indicated and appears necessary, we have at our disposal many of the ordinary cleansing and antiseptic solutions.

Among them may be mentioned hydrogen dioxide, diluted one to six times, especially used in the pharynx; normal salt solution, bichloride of mercury (1: 8000), lime water, boric acid (4 per cent.), Dobell's solution, Seiler's solution, and others of similar nature. The solutions should be applied warm, and should be bland, to obviate any excoriations. Irrigation of the nose is often very difficult owing to the nasal obstruction. This sometimes may be partially overcome by first dropping in a mild solution (½ per cent.) of cocaine, mixed with adrenalin, which will cause sufficient depletion of tissue to allow the solution to run through. Our efforts may be aided, if the child be old enough, by the proper blowing of the nose.

Much may be accomplished in cases of nasal irrigation by attaching a small perforated flexible rubber catheter to the douche and passing it through the nose to the nasopharynx and the pharynx below. By this means a more thorough application of the douching may be obtained. Unless there be a competent nurse in charge, the physician should either attend personally to the douching or thoroughly instruct those in charge of the patient. The patient, physician, and those in attendance, as well as the bedding and floor, should be well protected, and, if possible, the discharges should be allowed to flow directly in a large basin held under the chin or over a rubber sheeting to a receptacle on the floor. I think the fountain syringe is one of the best means of applying local solutions, for by it we can easily regulate both the amount and force, and with due attention to the details of position of the child, and caution in its use, it is as free from danger and will accomplish perhaps more than any other means at our disposal.

Aside from the antitoxin and local treatment, it is also necessary in certain cases to assist on the general lines of supporting treatment and to meet individual indications as they present themselves. Among these may be mentioned proper nourishment, the combating of unusually high temperature, cardiac weakness, albuminuria, the various sequelæ, and attention to the general health. Absolute rest in bed until all danger of postdiphtheritic paralysis and muscular weakness have passed should be strongly insisted upon.

Attention to sanitary details is very important in preventing the spread of contagion, and should include as much as possible complete isolation of the patient from other members of the family, the proper ventilation and sunlight of the sick-room, the wearing of protecting gowns on the part of attendants and physician, the cleansing and sterilization of receptacles and instruments of examination, the use of separate pieces of gauze about the face and hands, which should be immediately destroyed after use, and, above all, personal cleanliness on the part of all who come in immediate contact. These and all other details of like nature have an increased importance when we remember that it is mostly by direct contact that the contagion of diphtheria is carried.

Prognosis. That the present mode of antitoxin treatment has caused most remarkable decrease in the fatality of diphtheria must be received as an accepted fact, and by its use a most favorable prognosis may be given; especially is this the case in laryngeal diphtheria, both in obviating the necessity of operative procedure when given early and most materially aiding in bringing about a favorable termination in those cases where tracheotomy or intubation has to be performed. This is most strongly emphasized in the report of a collective investigation carried on by the American Pediatric Association.[1]

A brief reference to the statistics of the Boston City Hospital, as given by Rotch,[2] will serve to emphasize the question of favorable prognosis. In a stated number of cases before the days of antitoxin the death-rate was 50 per cent. as compared to 13 per cent. and 10 per cent. since its use. The great decrease in fatal cases is further seen in individual private practice and in institutions where the disease develops, and we have the words of so eminent an authority as the late Dr. O'Dwyer, who said, "had he waited until antitoxin had been discovered he never would have invented intubation."

INTUBATION.

The Mechanical Treatment of Laryngeal Diphtheria. When the croupy breathing from the stenosis of laryngeal diphtheria becomes urgent, either before the action of antitoxin becomes evident, or when seen in its severity before antitoxin has been given, the question of relief by operative measures becomes paramount. To meet this condition, we have two procedures, viz.: tracheotomy and intubation. In this article the latter only will be considered, as without going into any comparative merits of the two measures, we can safely say that as a primary operation intubation has competely superseded tracheotomy. The indications are the same for the two operations. For the technique of tracheotomy the reader is referred to works on surgery.

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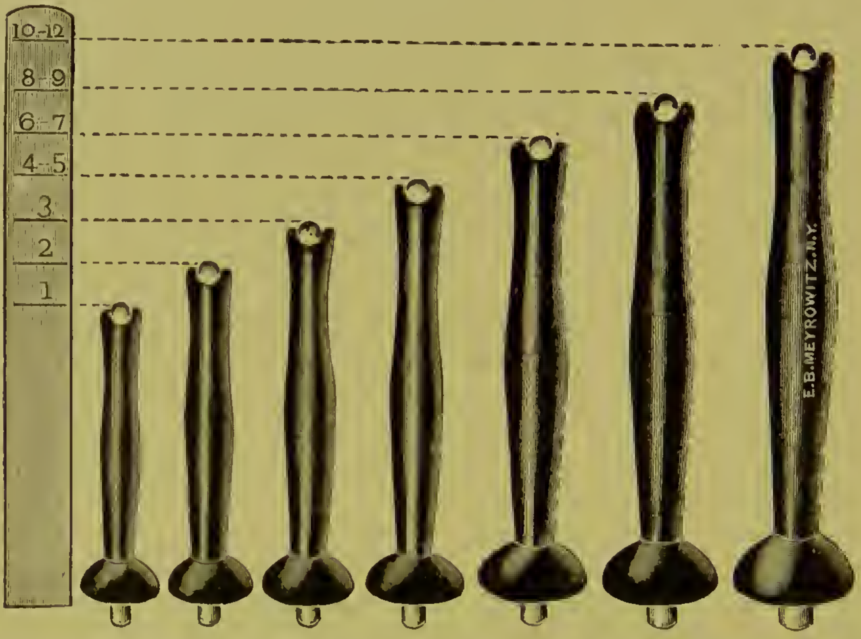
[1] Archives of Pediatrics, July, 1896.

[2] Loc. cit.

Although there have been placed before the profession a number of modifications of the original intubation instruments as originated and perfected by the late Dr. Joseph O'Dwyer, of New York, this article will refer only to the O'Dwyer instruments, as they are the ones used almost to the entire exclusion of all others.

FIG. 422.



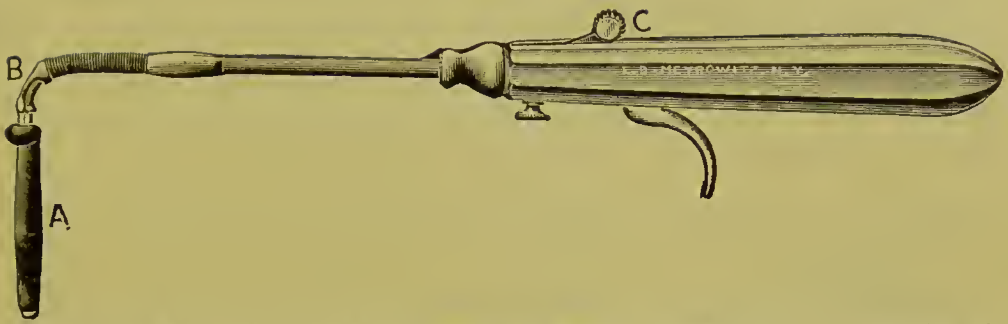
O'Dwyer's intubation tubes. The figures on the scale denote the age for which a given tube is indicated, the tube being measured on the scale, the length of the tube corresponding to the age, as shown by the figures.

The instruments for intubation consist of:

1. The tubes, made of hard rubber, with metal lining.
2. The obturators, screwed on the introducing-handle. In this respect a recent improvement has been made by Ermold, of New York, by which the obturator is continuous in one piece with the rod, which fits in the introducing-handle, thus doing away with the thread, which sometimes becomes loose at the junction of the handle and the obturator, allowing the tube to turn.
3. The introducer.
4. Extractor.
5. Scale.
6. String.
7. Mouth-gag.

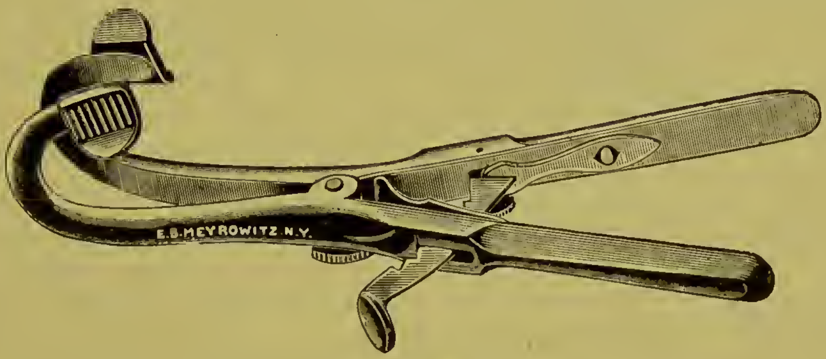
The tubes are of variable sizes, to suit the required age, and are chosen according to the scale.

FIG. 423.



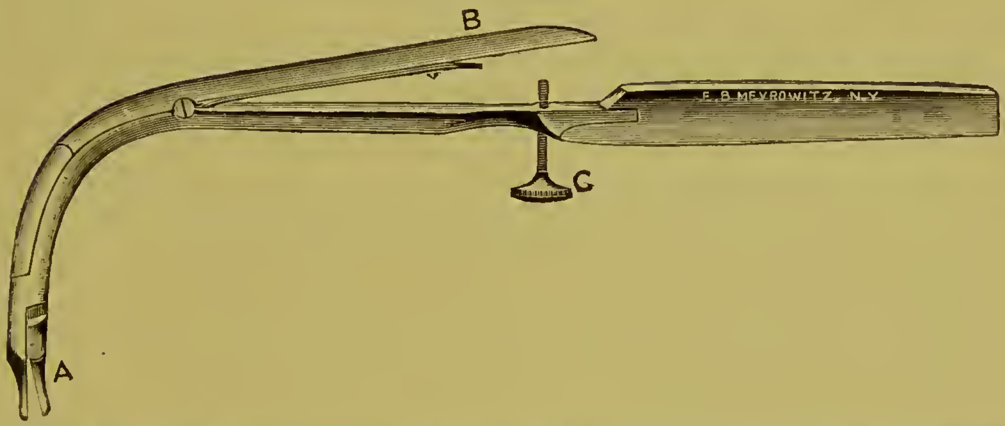
Intubator with a tube in the proper position for insertion in the larynx. A. Intubation tube B. Fork, pushing tube away from obturator. C. Knob which, when pushed forward, causes the fork to strike the head of the intubation tube.

FIG. 424.



Mouth-gag.

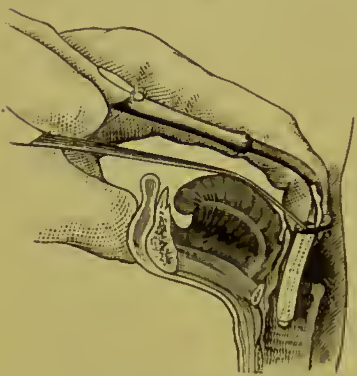
FIG. 425.



Excubator. A. The jaws partly open. B. Lever, pressure on which in a downward direction opens the jaws. C. Screw which regulates the extent to which the lever may be depressed and the jaws opened.

Technique of the Operation. The patient should be held firmly upright on the left thigh of an assistant whose legs are tightly closed on the patient's legs. The left arm of the assistant is thrown around the back of the patient, holding the left hand and arm of the latter, while with the right hand the assistant holds the patient's right hand. The right side of the patient is firmly held against the breast of the assistant, the left side of the patient being free. The second assistant stands back of the patient, holding the head firmly in a suspended position, and steadying the mouth-gag with the left hand. There should be no twisting of the neck of the patient, who should be held perfectly straight. This cannot be too strongly emphasized, as it especially pertains to the successful introduction of the tube. The proper-sized tube having been chosen according to the scale,. it should be threaded, always using braided silk of a size which will pass easily through the opening in the tube, and of a length which will permit of being looped over the patient's ear when the tube is in position, and so tied that the knot is always at a point farthest away from the tube.

FIG. 426.



To show the method of intubating the larynx.

The operator, standing or sitting in front and a little to the right of the patient, at a height which gives easy access to the mouth, the patient's mouth being well open and the gag on the left side, passes his left forefinger well down into the larynx over the epiglottis until he feels the two small tips of the arytenoid cartilages, which indicate the posterior portion of the larynx. The sensation imparted to the finger is the same as feeling the tip of one's nose. Then the introducing instrument is quickly passed down over the palmar tip of the left forefinger until the end of the tube engages in the larynx, gentle pressure being continued until the tube is well down in the larynx, when the left forefinger is transferred to the head of the tube and the obturator removed by liberating the sliding catch on the handle of the introducer. The left forefinger should remain, gently pressing the head of the tube, until the obturator is well out of the mouth. Care should be taken that the obturator is not removed in any way from the tube until the latter is well down in the larynx, thus avoiding any danger of stripping off or wounding the mucous membrane.

Successful introduction of the tube is almost immediately rewarded by relief from the difficult breathing, which becomes more and more marked as the minutes go by, and the patient passes into a condition of rest which is in marked contrast to that which necessitated the operation. The means of knowing that the tube is properly placed in the larynx are, first, the relief in breathing, and second, the characteristic cough, which immediately occurs and is of a moist metallic, character, produced by mucus and air passing through a metallic tube. This cough should always be looked for, and if not present should be provoked by the administration of a teaspoonful of diluted whiskey or brandy. The character of the cough is peculiar, and is far better appreciated by being heard than from any description. Ofttimes, in moribund cases, the cough may be delayed or be but feeble when it is heard. The cough is valuable in clearing the trachea of secretions and as an indication of the firmness with which the tube is retained in the larynx.

Another way of determining whether or not the tube is in the larynx is by passing the left index finger down into the œsophagus and feeling the tube through the anterior wall of the former. This means is of great service if for any reason the breathing is not fully relieved, and if it is desired to be positive as to the position of the tube. If, however, after the introduction of the tube, the breathing is not relieved or becomes suddenly worse, the question of having pushed down with the tube some detached membrane is to be considered. This accident may happen, but, as a matter of fact, it is very rare. If it were of frequent occurrence it would be a most serious objection to the operation. The reason of its infrequency is that the stenosis is not entirely due to a complete membranous cast of the larynx and trachea, through which the tube has to pass, but also to a lessening of the lumen of the larynx by infiltration of the submucous tissue. This can be easily observed in a cross-section of a larynx from a case of diphtheritic croup.

The accident mentioned is more likely to occur in late cases of croup in which the membrane has begun to exfoliate, and at any time when traumatism has been occasioned by the introduction of the tube it is accompanied by excessive coughing and a flapping sound, caused by the loosened membrane. If for this or any other reason the breathing is not relieved, the tube should be withdrawn by the string and the child encouraged to dislodge the loosened membrane by coughing, after which a second attempt at introduction should be made. It sometimes happens that pieces of detached membrane accompany the withdrawal of the tube. If it is reasonably certain that loose membrane is blocking the tube and is not readily expelled, a short cylindrical tube (foreign-body tube) may be inserted. These tubes for a given age are much larger in calibre than the ordinary ones, and allow large masses of membrane to be expelled. Owing to their larger size they should not be left in the larynx more than a few hours, on account of the pressure which they cause.

Another accident which may possibly occur is the introduction of the end of the tube into one of the ventricles of the larynx. This is obviated by using the present type of tubes, somewhat bulging on the end, which thus permits them to override the ventricles, and by keeping in the median line during introduction. Introduction of the tube into the œsophagus will sometimes occur. This can be appreciated by failure to relieve the difficult breathing and by attempts on the part of the patient either to expel the tube or by efforts to swallow. If the string is observed to be disappearing within the mouth it is evident that the tube is in the œsophagus, and it should be immediately withdrawn. This accident is an avoidable one, and need not occur if the proper rules are followed. In the cases in which I have seen the tube swallowed it has passed through the alimentary canal within from two to four days without any accident. The tube may be occasionally swallowed when coughed up by the patient.

The string should be permitted to remain in place, being passed over the left ear until quiet breathing is restored, from fifteen minutes to half an hour, and should then be removed by cutting one side of the loop close to the mouth, taking hold of the long end and withdrawing while the left forefinger is making gentle pressure down on the head of the tube. Never, under any circumstances, remove the string without making pressure on the head of the tube, as the string becomes twisted in the mouth and will be caught in the eyelet of the tube and the latter itself withdrawn unless the counter-pressure is made. Another very important precaution in regard to the string is that the person holding the child should never release the child's hands until the string is removed by the surgeon. Almost the first thing a child will do if the hands are released is to instinctively pull at the string, resulting, of course, in withdrawal of the tube.

It is the practice of some, in preparing the child, to tightly encase the arms and chest in a draw-sheet wrapped around the body. While this keeps the hands out of the way, it is open to the objection of too firmly constricting the chest, and, in case of artificial respiration being necessary, much valuable time may be lost. Also some operators prefer to introduce the tube while the patient is in the dorsal position. I have had no experience with this mode of procedure, and cannot speak of its merits.

In extracting the tube the same precautions as to the position and management of the patient during introduction should be followed. The instrument for this purpose is called the extractor. Before being used it is absolutely imperative that the thumb-screw on the under side of the instrument should be so set that the distal jaw can open just sufficiently to exert the proper amount of pressure within the opening in the tube. If the jaws are open too widely there is great liability of lacerating the surrounding mucous membrane in ineffectual attempts at removal. It is good practice to test the degree of opening of the extractor on a tube of the same size as the one in the larynx. In extracting, after the introduction of the mouth-gag, the left forefinger should be passed down on the head of the tube until the opening is felt, and then the extractor, closed, is passed down until the point strikes the head of the tube and enters the opening in front of the tip of the finger. When, in the opening of the tube, the jaws of the instrument are opened by thumb-pressure on its handle, and the tube withdrawn, pressure being continuous until the extractor and tube are removed from the mouth, never have the thumb on the lever until you feel sure that the end of the instrument is in the tube.

The operation for extracting is perhaps more difficult than that of introduction, as it requires a finer degree of touch to determine the opening in the head of the tube, and the difficulty is increased in proportion to the smallness of the tube. Modifications, from time to time, have been made in the head of the tube and in the extractor to facilitate removal; but the original procedure, just described, is the one almost universally employed. Extraction by pushing out the tube from below without any instrument may successfully be performed, if for any reason great difficulty is experienced in the application of the usual method, or in case of emergency, when the tube must be removed by the nurse in the absence of the surgeon. This is done by slightly inverting the patient and, with mouth open, placing the thumb in the episternal notch and pushing the tube up in the mouth and grasping it with the fingers of the other hand, or with a pair of ordinary forceps. This can be done by anyone of ordinary intelligence in charge of the case, and is, under these circumstances, a most admirable method of extraction.

After removal of the tube the patient should not be left until there is sufficient evidence that the tube will not have to be replaced. A small dose of opiate may then be given to allay cough and irritation. Slight cough and hoarseness generally continue a few days to two weeks, especially the hoarseness, which, however, passes away without incident.

Feeding after intubation is best accomplished by having the child in an inclined position, the head being down. This is commonly called the "Casselberry" method. It is best performed by raising the foot of the bed, removing the pillow, and bringing the child to the edge of the bed on the side, and using for the purpose of feeding an ordinary duck-shaped feeding-cup. This procedure prevents, in a great measure, fluids from entering the tube and the accompanying paroxysms of coughing. However, it is remarkable how readily some children, with a tube in the larynx, will learn to swallow in the ordinary upright position.

I consider it also very excellent practice to keep the patient in the feeding position during the entire period in which the tube remains in the larynx, in order to lessen the chances of secretions passing down through the tube, and thus, possibly, causing the development of pneumonia. The frequent removal of the tube for purposes of feeding has been advocated by some, but I think such a practice should be mentioned only to be condemned.

The food should be fluid or semisolid, solid particles of food being avoided, so as not to run the danger of large pieces being drawn into the tube. In case great difficulty is experienced in the use of the mode of feeding mentioned above, recourse may be had to alimentation through the œsophageal catheter, passed either through the nose or through the mouth, or, as a last resort, rectal alimentation may be employed.

I think it most important to watch the respiration during the entire period of intubation, as bearing on the progress of the disease. If they continue about normal it is indicative of favorable progress;

if they show a tendency to increased rapidity, it is indicative of extension of the membrane. Fortunately, however, the latter does not occur as frequently as it did in pre-antitoxin days.

The prognosis of diphtheritic croup under the present combined treatment is, I think, remarkably favorable, especially as compared with the results formerly obtained. A reference to this point in the report of the collective investigation of the American Pediatric Society, referred to above, gives the mortality in cases operated upon by intubation, and in which antitoxin was administered, as 27.24 per cent. This is in strong contrast to the previous mortality, which ranged from 69.5 per cent. to 75 per cent. I have no doubt that the prognosis will continue to be even more favorable as there is gained a better understanding of the combined treatment.

In a very small number of cases it may become necessary to perform tracheotomy in the event of failure of intubation; but when this has been done the percentage of recoveries has been very small, and conditions have been found which could hardly be reached by either operation.

In contemplating the performance of intubation one should not rely entirely upon written description for his guidance, but should acquaint himself with the operation by practice on the cadaver. This is, I think, a *sine qua non.* The perfected tubes of the present time are made of hard rubber over metal. This, as I have said before, allows the tube to be retained longer without the occurrence of calcareous deposits. These tubes exert less pressure, and can be more easily expelled in case of plugging with membrane.

When to Operate. The question of when to operate is always of vital importance, and especially so if for any reason antitoxin is not employed. We can recall the various opinions which have been held on this point, ranging from intubating at the very beginning of the manifestations of croupy symptoms to waiting for the more positive condition of progression marked by recession of the extraneous muscles of respiration and signs of cyanosis.

It has been well proven by the report of the American Pediatric Society, already referred to, that in 60 per cent. of the cases of laryngeal diphtheria, intubation is not required, if reliable antitoxin has been properly administered at an early stage of the disease. If, however, croupy symptoms supervene and progress, the use of the antitoxin should be continued, the dosage being based upon the age of the child and the amount previously given, and at the same time the croupy symptoms should be watched, remembering that it sometimes requires twenty-four hours for the full effect of the antitoxin to be manifested. This is especially important if the symptoms of laryngeal stenosis are the first indications of the presence of diphtheria. In either event, and here the initial dose of antitoxin should be a full one, in the interval while waiting for the antitoxin effect, if the symptoms of stenosis are progressive, intubation should be immediately performed; *never,* in any instance, is it justifiable to await the approach of the severer symptoms of stenosis. After intubation, the use of antitoxin should be continued on the principles already given, to be discontinued as the membrane shows a marked tendency to exfoliate and the respiratory symptoms a tendency to disappear, and as to the other general conditions, especially the pulse and temperature resume a more nearly normal condition.

How Long Shall the Tube Remain in the Larynx? In pre-antitoxin days the average period during which the tube was allowed to remain in the larynx was from six to seven full days. Under the present mode of combined treatment the time may be somewhat shorter, varying in different experiences from three to five days. The usual time at the Willard Parker Hospital is at present four days, and at the New York Foundling Hospital three days. Personally, in private practice I prefer to leave the tube in the larynx during five full days, if there are no indications for removing it, on the general principle of avoiding unnecessary reintroductions.

In hospital practice, where assistance is always at hand in case of emergency, there is less danger in leaving the tube in a shorter time, for, should occasion arise, it can be at once replaced. Verbal reports from the institutions mentioned do not show any comparative increase of the necessity for reintroductions between the older and the present methods of combined treatment. The duration of the disease has been so shortened by our present treatment that undoubtedly in many cases the tube may be removed earlier without the necessity of reintroduction.

The principal indications for removing the tube previous to its final removal are severe discomfort or pain from pressure, especially if the pain be radiating in character, thus indicating the occurrence of ulceration, severe attacks of coughing, and sudden stenosis due to the lodgement of membrane in the lumen of the tube. This last-named condition is, perhaps, more likely to arise earlier under the antitoxin treatment on account of the earlier exfoliation of the membrane. In some instances, however, if the membrane be sufficiently loosened to block up the tube, the latter will be coughed up with the membrane. This is especially the case with the present rubber tubes, especially if the tube does not fit too tightly. If under these circumstances the tube is expelled, its reintroduction may not be necessary, or, at any rate, the necessity of reintroduction will, as a rule, be sufficiently delayed to permit reintroduction by the physician in charge.

In a small percentage of cases of intubation, after the original cause of the stenosis has ceased to operate, there occurs a more or less permanent stenosis, necessitating almost constant use of the tube for the period of a few days to some months. These cases are classed under the head of "retained intubation tubes." The course and treatment of this condition are most elaborately set forth in a classical article by Dr. O'Dwyer, read before the meeting of the American Pediatric Society, 1897, to the report of which I refer the reader for a detailed exposition of the subject, although it requires further experience for its full elucidation, which will only come from a very careful study of the few cases that will occur from time to time.

Dr. O'Dwyer, in giving the cause and seat of this persistent stenosis, says: "1. The cause of persistent stenosis following intubation in laryngeal diphtheria can be summed up in the single word, traumatism. Paralysis of the vocal cords may possibly furnish an occasional exception to the rule. 2. The injury to the larynx is done by a tube which does not fit properly. It may result either from an imperfectly constructed tube, or from a perfect one which is too large for the lumen of the larynx, although suitable to the age of the child, or from a tube that is perfect in fit and make, if it is not cleaned at proper intervals. 3. The seat of the lesion which keeps up the stenosis is just below the vocal cords in the subglottic division of the larynx, or that portion bounded by the cricoid cartilage. Exceptions to this rule result from injury produced by the head of the tube on either side of the base of the epiglottis just above the ventricular bands."

Dr. O'Dwyer sums up the avoidance of its occurrence and its treatment when present in a full appreciation of its causes and the skilful use of tubes of proper size, shape, and construction, and the use of the hard-rubber tube now in vogue, which can be worn indefinitely without the occurrence of the calcareous granules which appear on the metal tubes, and which may become a focus of ulceration; further, the rubber tubes at their impinging points do not produce the same degree of pressure as do the metal tubes.

SYPHILIS OF THE NOSE AND THROAT.

Syphilis of the nose and throat may be either congenital or acquired. When congenital it generally shows itself in very early life; although it may be somewhat delayed, it usually makes its appearance before the age of puberty. It is generally associated with other bodily lesions, and our first attention is attracted by the usual manifestations of a syphilitic birth, viz.: snuffles of the nose, malnutrition, and possibly ulcerations of the skin.

In attacking the interior of the nose it usually shows a preference for the bony structures, especially the septum, but may attack the other bony portions, and as the patient grows, if it outlives the first manifestations it generally results in a loss of the septum and the characteristic falling-in of the bridge of the nose. Sometimes adhesions take place within the nose, producing more or less complete obstruction.

Pharynx. Congenital syphilis of the pharynx is perhaps more common than that of the nose, but frequently they exist together, being simply an expression of the general syphilitic invasion. John N. Mackenzie, speaking of the time of appearance, states that about 50 per cent. of the cases occur within the first year of life, and as many as 33⅓ per cent. within the first six months. The usual mani-

PLATE XXVI.

FIG. 3

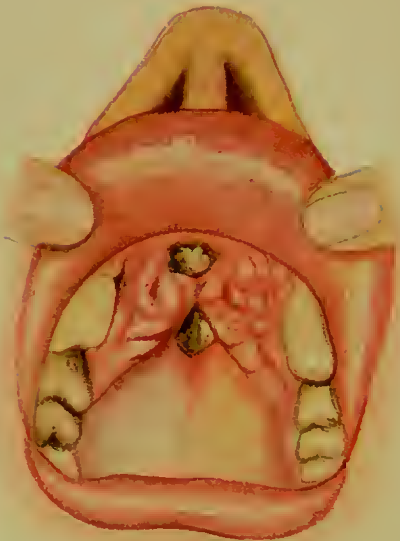


FIG. 1

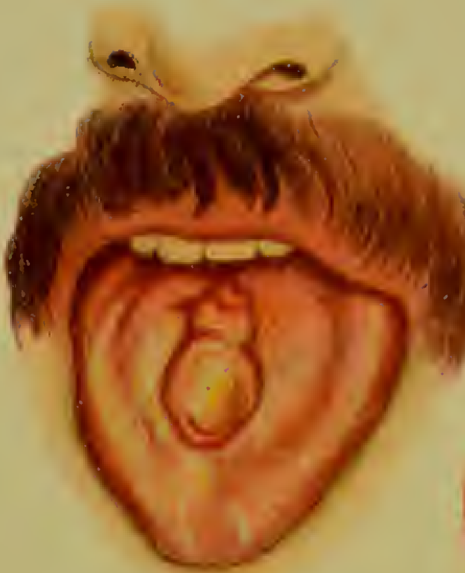


FIG. 4

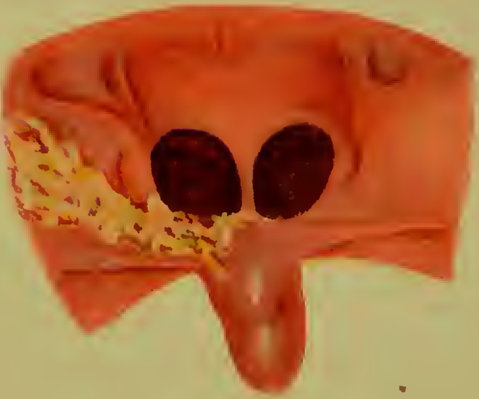


FIG. 2

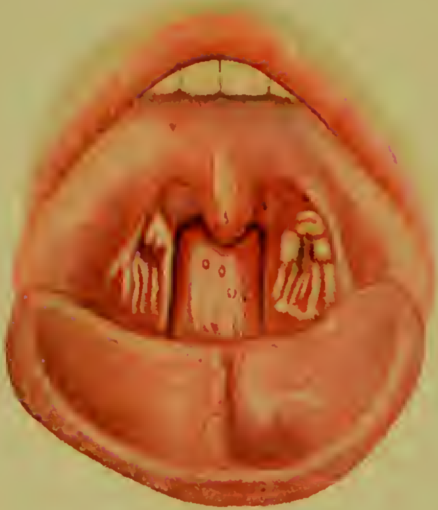


Fig. 1. Primary Syphilis of Tongue.
Fig. 2. Secondary Syphilis of Fauces.
Fig. 3. Tertiary Syphilis of Hard Palate.
Fig. 4. Tertiary Syphilis of Soft Palate.

festation in the pharynx is an ulceration, generally attacking the bony structure first, viz.: the hard palate, producing perforation, and in some instances almost complete destruction of the pharyngeal wall, and when the soft palate and faucial pillars become ulcerated, it usually ends in the production of adhesions between the pharyngeal wall and soft palate. Congenital syphilis of the larynx is very rarely seen. The general type and appearance of the lesion does not vary from the lesion of the acquired tertiary form, which will be described more fully under that heading.

Acquired Syphilis. In its primary form under the term of extragenital chancre, the initial lesion is rather infrequent in the nose, but more frequent in the lips, tongue (Plate XXVI., Fig. 1), and sometimes occurring on one or other of the tonsils. When seen in many of these positions it does not vary from the general type of genital chancre, viz.: that of a localized induration with more or less superficial ulceration. From its rarity in this position it is not infrequently mistaken for epithelioma, but the subsequent secondary manifestation soon establishes its character. As a rule, the secondary symptoms follow more quickly, and by some authors it is said, more intensely and become more severe in their nature than when the chancre is of the usual genital variety.

Secondary Syphilis. Secondary syphilis is extremely rare in the nose; in the pharynx (Plate XXVI., Fig. 2) it is extremely common, and occurs in a very large proportion of those affected with syphilis, appearing almost any time within a few weeks to months after the initial lesion and associated as a rule with other secondary manifestations. It may attack any portion of the cavity of the mouth, viz.: lips, insides of the cheek, the sides of the tongue, or the fauces. It is most characteristic when seen in the faucial region, usually manifesting itself by a symmetrical erythema, having a distinctive bilateral fan-shaped appearance, spreading over the anterior pillars of the fauces, and usually including the tonsils and the posterior pillars. In a well-marked virulent case the entire posterior region may become implicated, and sometimes it spreads to the nose, naso-pharyngeal space, and Eustachian tubes. In typical cases our attention becomes almost immediately directed to this bilateral hyperæmia of the fauces by observing their superior reddened margins as the tongue is depressed and as they stand out in relief against the paler color of the superior portions of the palate. Within this area of faucial erythema and at various points there appear the characteristic pearl-colored plaques called "mucous patches," which are slightly elevated from the surface of the erythema, and frequently have an appearance as if they had been flattened out. When small or more or less isolated, they are generally crescentic in appearance, and it is not infrequent in well-marked cases to have the entire faucial region, including the tonsils, covered with the mucous patch.

Although a typical case of secondary syphilis as above described is comparatively easy of diagnosis, and when once seen cannot very well be confounded with any other lesions, the diagnosis of a mild or a fading case is often very difficult of diagnosis. It is not infrequent to notice a bilateral hyperæmia of the fauces which is benign in its character, but the hyperæmia of secondary syphilis is deeper and more submucous in its nature and may be paler in color, and usually, if not always, when the free edges of either the anterior or posterior pillars have been affected there will be left evidences of a slight erosion somewhat serrated in appearance.

In reaching a conclusion in these difficult and suspected cases I have come to look upon this last appearance as a very strong point in the diagnosis. Sometimes the secondary manifestations affect the tonsils only, producing what may be called a syphilitic tonsillitis. When this occurs the tonsils become acutely enlarged, of a pale-gray color, and their whole surface covered with this irregularly-shaped gray plaque formation. This hypertrophy is very stubborn in character and yields but slowly to treatment. It is not necessary here to detail the evidences of general systemic involvement, which, however, must be looked for in diagnosis.

The subjective symptoms of faucial secondary syphilis are those usually of an ordinary sore-throat, but lasting much longer, the pain and intensity of which vary with the severity of the case. When severe, a more or less decided salivation is present.

Secondary syphilis of the pharynx is very prone to recurrence, and even after being apparently thoroughly obliterated by treatment it may recur often after the lapse of months.

Diagnosis. It usually lies between herpes, diphtheria, follicular tonsillitis, aphthous sore-throat, and tubercular ulceration, the various characteristics of which will be described under their separate headings.

Secondary Syphilis of the Larynx. This is comparatively rare in occurrence and exists usually associated with secondary syphilis of the pharynx. Very rarely does it exist by itself. There are the subjective symptoms of irritation of the larynx with more or less hoarseness, the hoarseness being of a peculiar raucous character. The local appearances are those of a more or less catarrhal infection of both the true and false cords, with hyperæmic spots and sometimes the appearance of a true plaque formation, or very superficial ulcerations, usually bilateral, on the vocal cords. The epiglottis is also sometimes the seat of the same manifestations, and, in addition to the ordinary secondary symptoms as described, we may have a formation of condylomata of the laryngeal mucous membrane, which excrescences may become sufficient to cause considerable stenosis of the larynx. In one instance reported by the writer the stenosis was sufficient to warrant an intubation to save the life of the patient.

The treatment of secondary syphilis of the throat is mainly constitutional in character, consisting of the administration of mercury in some of the usual forms, and when the character of the manifestations seem to be deep with infiltration the treatment is enhanced by the addition of the iodide of potash, commonly called the mixed treatment.

Local treatment, although sometimes used, as a rule is unnecessary, as the condition generally responds to constitutional treatment and the object of the local treatment would be only as a matter of cleanliness. If the mucous patches of the pharynx are very extensive it is possible that their healing may be somewhat hastened by the application of mild caustics. Among the various sprays or antiseptic gargles which may be used, a gargle consisting of the ordinary black wash, diluted, is of assistance in the treatment.

Tertiary Syphilis. Tertiary syphilis of the nose and throat is very common and one of the most frequent manifestations of the tertiary form of the disease. It is peculiarly ulcerative and destructive in its nature, being the result of a breaking down of a gummatous infiltration, resulting in the nose in the destruction of the septum and other intranasal bony portions, and in some cases producing, by the necrosis of these bones, a falling in of the exterior of the nose, with its characteristic deformity.

Nose. In the nose it usually begins with symptoms of more or less severe intranasal irritation, soreness and pain being quite prominent, nocturnal pain being very characteristic. When high up, external swelling with some redness and tenderness on pressure are frequently noticed, causing quite a noticeable broadening of the bridge of the nose. As the condition progresses nasal obstruction becomes more and more marked, and soon there supervenes a breaking down or ulceration of the induration; this may take place at any point, but usually begins on the septum. It may be unilateral or bilateral, generally the latter, attacking either the cartilaginous or bony septum, and in its course may include the entire intranasal bony structure. Ulceration at the external nasal orifice is often noticed, and it may extend to contiguous portions of the upper lip. With this ulceration there is associated a bloody mucopurulent discharge frequently extensive in amount, with dislodgement and expulsion of parts of the intranasal mucous membrane and bony portions; sometimes the discharge becomes hard and dry, and is either expelled in inspissated masses on the part of the patient, or requires the assistance of the surgeon. After the necrosis has existed for some time the discharge becomes very offensive and characteristic in odor.

Treatment. Treatment other than constitutional by iodide of potash, which will be all-sufficient if the nasal invasion is recognized early, before deep destruction is established, must be supplemented by thorough and repeated cleansing, which is all-important, by stimulation of the ulcerations by mild caustics and by insufflations of iodoform or by some of its equally good substitutes.

When bony necrosis is present and the sequestrum is not as yet loose, curetting or trephining may be employed. When any portion of the bony structure becomes loose the sequestra may be removed by rongeur or traction forceps or by their combined use; when too large for removal by either of the above combinations it may be necessary to resort to some major operation, among which may be mentioned that of Rougé,[1] which consists in the removal of the sequestrum through exposing by incision the intranasal cavity by eversion of the upper lip and external nose, thus leaving a minimum of deformity as the result of operation.

Pharynx. In the pharynx any portion may be attacked, resulting in more or less loss of tissue, and producing adhesions and cicatrization of the various parts affected, with perforations both of the hard and soft palate. (Plate XXVI., Figs. 3, 4.) The lesion may be unilateral or bilateral. The cicatrix, we might say, is always present as a result of a severe type of ulceration. It is quite characteristic, being whitish or yellowish in color, and more or less stellate and radiating in shape, and may occupy an extensive area from the nasopharynx to the larynx, according to the extent involved. This cicatrization is one of the most characteristic evidences of tertiary syphilis. In extensive cases the resulting cicatrization, adhesions, and contraction may materially encroach on the lumen of the pharyngeal space, so as to seriously impede the power of deglutition. When seen early, before ulceration has taken place, there is generally a marked induration (the gummatous formation), the surface of which has more or less of a velvety appearance, and is seen most typically when it affects the soft palate. The surface of the induration is red and angry in appearance, and soon gives way to a breaking down or ulceration at almost any point.

The character of the ulceration is that it is deep and destructive in nature, the edges more or less well defined, irregular in appearance, and the surface of the ulceration, as a rule, covered with a thick, yellowish, ropy secretion. This feature varies according to the parts involved, there being, as a rule, more of the thick secretion when the posterior pharyngeal wall is implicated. Subjectively there may be more or less pain, with pain and difficulty in deglutition; but severe pain is not a constant characteristic as compared with the pain of malignancy or tuberculosis, and, indeed, it is quite common to find quite an extensive amount of ulceration with comparatively little pain. This will depend upon the area involved.

Diagnosis. The diagnosis of tertiary syphilis of the pharynx lies between tuberculosis, malignancy, lupus, traumatisms, and ulceromembranous angina associated with the bacillus of Vincent.

Treatment of pharyngeal syphilis is mainly constitutional, in the administration of iodide of potash aided by thorough cleansing of the parts and possibly the application of mild caustics, as indicated in the individual type and condition of the ulceration. The resulting adhesions require suitable surgical means of dilatation and excisions to meet the special case.

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[1] Rougé's Operation for Removal of Nasal Sequestrum. Dr. C. H. Knight, New York. Philadelphia Medical News, January 3, 1891.

Tertiary syphilis of the larynx is of very common occurrence, being present in a large percentage of cases of syphilitic infection, although perhaps not as frequent as pharyngeal involvement. It may become affected independently or by extension from the pharynx. The lesion may be localized to one portion or involve the entire structure of the larynx. The nature of the lesion is the same as in other portions, viz.: a gumma with a subsequent destructive ulceration retaining the same generic characteristics, but only varying in the nature of the functional symptoms produced, as would naturally follow an invasion of that kind within the larynx.

Although there are instances of long-standing lesions of chronic thickening, where the cords lose their color and contour, the condition being kept in abeyance by treatment, and the principal symptom being that of hoarseness, still the tendency of tertiary syphilis is to produce an encroachment on the lumen of the larynx either in the formative stage of the development of the induration and early destructive ulceration, or in the resulting deformities of contraction, adhesion, and adventitious tissue, producing not only hoarseness, but the more serious condition of progressive impairment of breathing due to the laryngeal stenosis. Perichondritis of the cartilages may be produced, and may occur as a result of the necrotic expulsion of various cartilaginous portions. Pain within the larynx is a variable symptom, being more prominent in the early stages, before chronicity is established, and external pain and tenderness on pressure may ensue, according to the extent of the deeper involvement.

Treatment. The treatment is constitutional in giving iodide of potash, and in some instances of marked laryngeal involvement most excellent and rapid results have been procured by the combination with bichloride of mercury given hypodermically. For the mechanical treatment of resulting stenosis the reader is referred to the article on stenosis of the larynx.

TUBERCULOSIS OF THE NOSE, PHARYNX, AND LARYNX.

Tuberculosis of the nose is an extremely rare affection, and when existing is almost, if not always, secondary in its nature, and associated with pulmonary tuberculosis. It is by far the most rare of all the tubercular manifestations of the upper air-tract. Out of 426 autopsies of tuberculosis reported by Willigk, only one case was found in the nose, and out of 164 reported by Weichselbaum, only two were found. Reidel has reported two cases of primary tuberculosis of the septum, which existed for many years without the lungs in any way being affected. Hill reports one case in which the lesion is on the inferior turbinate bone, and Williams, Symonds, and Sachs also report primary tuberculosis of the septum.

It occurs, as a rule, in two forms; ulceration, generally on the septum or floor of the nose; or the hyperplastic form, either on the septum or the inferior turbinate bone.[1]

Some authors attribute perforation of the septum so commonly seen, to a tubercular origin. The latter course of the lesion is, as a rule, very slow and indolent in its progress, existing sometimes for many years without giving rise to very marked symptoms. The ulcers are painless, rather small, slightly depressed and irregular in shape, with a tendency toward the formation of crusts, and bleeding quite easily, their centre having a caseous appearance. The hyperplastic form is generally in the shape of small, grayish, warty growths, situated on the surface of an induration, rather soft and bleeding easily, and not unlike papilloma. The diagnosis is generally made on finding the tubercle bacillus. From the position of the lesion, local applications are easily made, but there is always a very marked tendency to recurrence.

The local treatment is the same, as will be described elsewhere, as in the local treatment of pharyngeal and laryngeal tuberculosis.

Tuberculosis of the Pharynx. Next to tuberculosis of the nose that of the pharynx is the most rare of the tubercular manifestations of the upper air-tract, and, indeed, until quite recently it was considered extremely rare, but later extensive individual research and observation have brought pharyngeal tuberculosis into a greater degree of prominence. It is almost always associated with laryngeal tuberculosis. It may attack any part of the pharynx, including the soft palate, uvula, tonsils, pharyngeal wall, and lingual tonsils, without any special reference to any one seat of election. When one part is affected it shows a rapid tendency toward extension, which in some cases is a very marked feature.

Symptoms. In a well-marked instance the subjective symptoms are those of very severe involvement of the throat, pain being a prominent and severe symptom, constant in character, and producing a very marked dysphagia. The general aspect of the patient is one of suffering and emaciation. The local lesion is generally one of ulceration of the type peculiar to tubercular ulceration of the mucous membrane, rather superficial and having an angry appearance, without much, if any, induration, excepting perhaps on the edges in the older cases, covered with a variable degree of secretion, and surrounded by a red, inflamed area, presenting frequently a coalescing tendency and the appearance of burrowing or a "worm-eaten" appearance.

The character of the ulceration seems deeper as it attacks the faucial or lingual tonsils, the author having seen almost an entire lingual tonsil rapidly destroyed by acute tubercular ulceration.

Prognosis. The prognosis is extremely bad, the patient succumbing either to the primary pulmonary tuberculosis or to the starvation and inanition produced by dysphagia from the pharyngeal involve-

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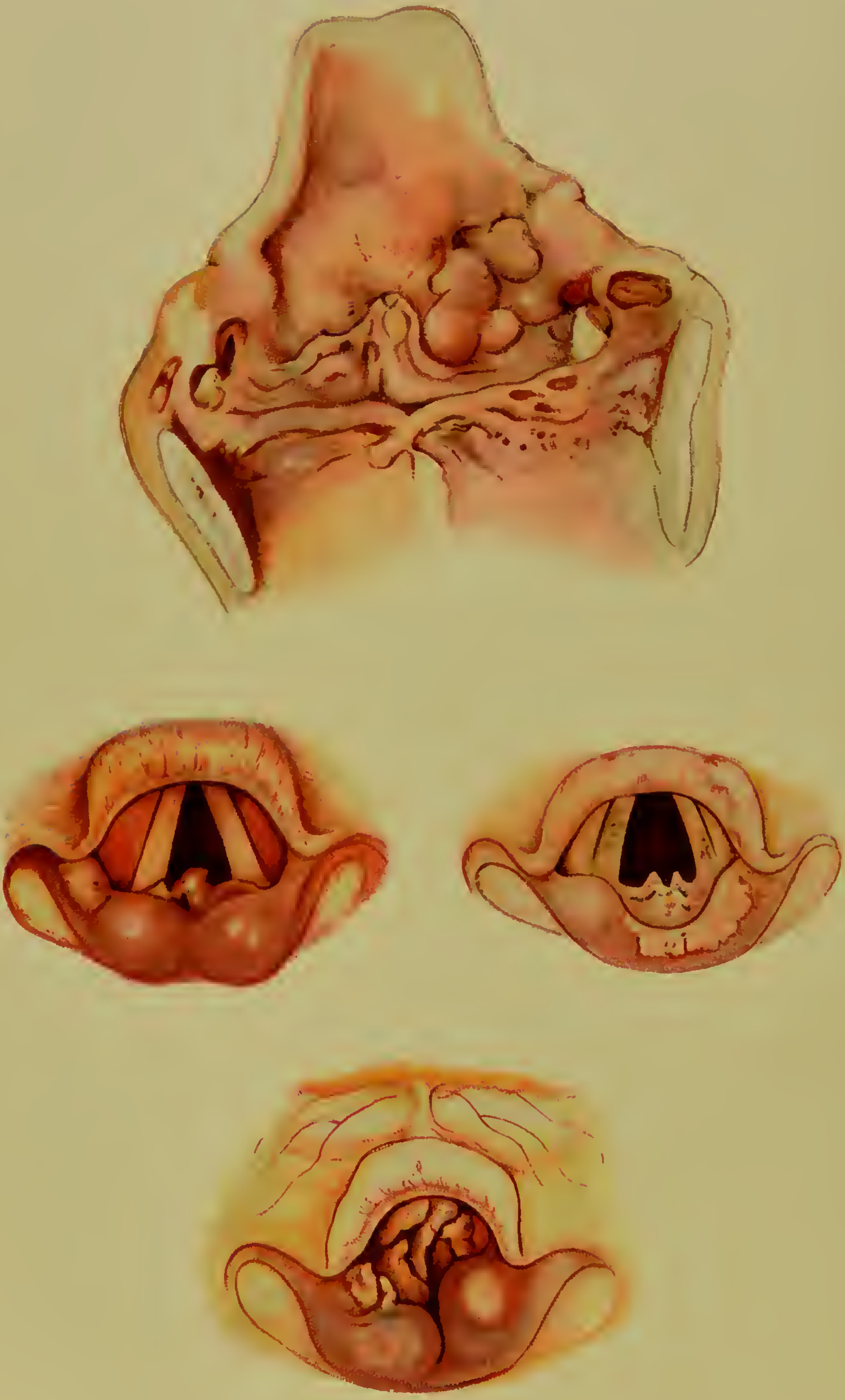
[1] Heryng, in a review of ninety cases, found the lesion to occur in forty-eight as ulcers and in forty-two as tumors.

PLATE XXVII.



Some Forms of Laryngeal Tuberculosis.

ment. Although the location of pharyngeal tuberculosis seems to be ideal for the application of local treatment, and although the individual areas of ulceration may become healed by treatment, there is always a marked tendency to extension. The local treatment in detail will be referred to under "Laryngeal Tuberculosis."[1]

The diagnosis lies between syphilis and carcinoma, and can be made positive by the finding of the tubercle bacillus in the secretion or by histological examination.

Tuberculosis of the Larynx. The larynx is by far the most common seat of tuberculosis of the upper air-tract, and it is, as a rule, if not always, secondary to or associated with pulmonary tuberculosis. Bearing on this subject of the frequency of laryngeal tuberculosis, in the report[2] of the Brompton Hospital, England, 50 per cent. of laryngeal tuberculosis is given as occurring in all cases of pulmonary tuberculosis. Willigk gives 237 cases out of 1300, and Kidd gives 20 per cent.

This view of laryngeal tuberculosis being always secondary, is held by almost all observers, and is proven by the findings of autopsies, there being very few recorded cases of death by laryngeal tuberculosis where pulmonary involvement has not been found. The opponents of this view are very few in number, the most prominent of them being Dr. Gleitsmann, of New York, whose researches have been extensive and who reports two cases of primary laryngeal and pharyngeal tuberculosis in his own practice which were cured. In the report of his cases in the *Journal of Tuberculosis*, April, 1891, he quotes Demme, E. Fraenkel, Pogrebinski, Orth, Coghill, J. S. Cohen, Dehio, and Lancereaux in support of his view.

The subject of primary tuberculosis of the larynx is so important, bearing on its progress and curability, that we may digress for a moment by saying that it is almost an impossibility to prove the existence of primary or dissociated tuberculosis of the larynx without autopsy. It is possible for the laryngeal involvement to be apparently primary to pulmonary involvement, by reason of the patient first calling attention to the larynx, or by the preponderance of the laryngeal condition, or to exist where the pulmonary tuberculosis may be for the time in abeyance. An examination of the chest may give negative results, but this in no wise proves that the lungs are not involved, and if we find during the course of the disease that the lungs do become involved, notwithstanding the fact that our attention has first been called to the laryngeal symptoms, we cannot say that the case was one of primary tubercular laryngitis. The association of the two conditions is very strong, if not positive evidence that the lungs were first involved and the larynx secondarily so, for we know that it is possible to have certain forms of pulmonary tuberculosis not giving rise to many physical symptoms at first.

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[1] In some rare instances of localized indolent forms of pharyngeal ulceration or indurations permanent healing has been obtained by local measures.

[2] Watson-Williams.

And, again, if laryngeal tuberculosis were primary or dissociated to any great extent there certainly would be more positive evidence of it when we consider the extremely common occurrence of laryngeal tuberculosis. It is true that in some instances laryngeal tuberculosis may preponderate over pulmonary tuberculosis for the time.

The author has seen many cases of tubercular laryngitis which he thought were primary, and which for a time seemed to yield to treatment; but the subsequent progress of the disease always proved fatal through the associated symptoms of pulmonary tuberculosis. It is possible in a suspected instance of primary tubercular laryngitis where the pulmonary signs are negative that the use of the X-rays may disprove or substantiate the presence of pulmonary tuberculosis.

Symptoms. The symptoms of tubercular laryngitis vary according to the type of involvement. In the typical case the first subjective symptom may be an alteration of the voice, which, of course, would depend somewhat upon the localization of the lesion. The voice becomes slightly hoarse; but it may progress to complete aphonia with the extension of the disease. The character of the hoarseness is more of the soft or weak variety as distinguished from the harsh quality of paralysis or laryngeal growths. This hoarseness is not always due to marked tubercular involvement, but may be due to the general muscular weakness of the larynx.

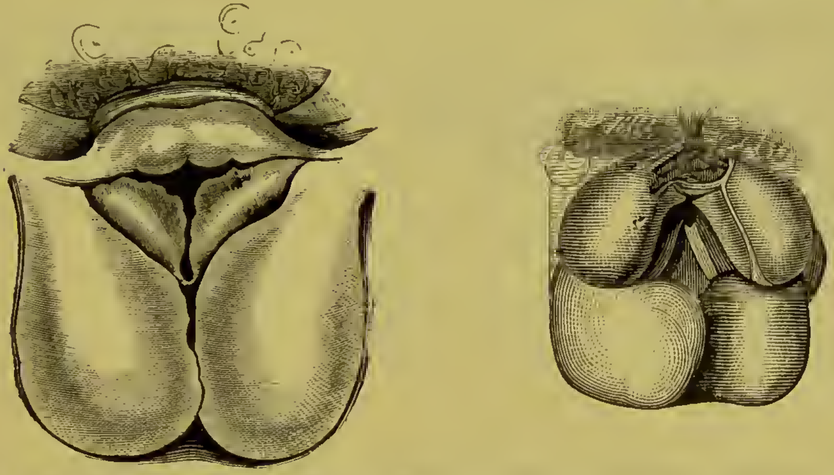
Cough is a very prominent symptom which may proceed either from associated pulmonary tuberculosis or from laryngeal irritation. Pain is also a very prominent symptom, especially where there is ulceration. The pain is, as a rule, lancinating in character and radiating to the ears. This latter feature when the larynx is involved is almost pathognomonic of laryngeal ulceration. The pain becomes excessive in accordance with the progress of the ulceration until it may produce marked and very distressing dysphagia. Excessive pain is indicative of decided ulceration.

Dysphagia is often a prominent symptom, especially in the later stages of the disease, and often to such an extent that patients refuse food both from their inability to swallow or from the excruciating pain which the latter causes. In the indurating and non-ulcerative type of tubercular laryngitis pain may not be a prominent symptom.

Expectoration and Secretion. Expectoration is almost always present, being of the usual tubercular nature, generated either in the lungs or in the larynx. Sometimes from the pain which any motion of the larynx produces, and from general weakness of the organ by the tubercular involvement, expectoration becomes very difficult, and from its thick character and accumulation within the larynx may give rise to severe fits of choking, ofttimes causing great exhaustion, after repeated efforts at expulsion. Vomiting is not infrequently caused by excessive efforts due to coughing and the endeavor to expel the mucus from within the larynx.

Appearances. Laryngeal tuberculosis is chiefly characterized by the appearance of induration and ulceration. In the usual variety of tubercular laryngitis the first change in the mucous membrane perceived by laryngeal examination is the change in color. In some instances the larynx becomes very anæmic, which is considered by some to be of pathognomonic significance, and when it is associated with other general conditions it is sometimes spoken of as the pre-tubercular anæmia. This anæmia is not, however, necessarily indicative of tubercular laryngitis, as it may be an expression of the general anæmia of the patient. There are some cases to the contrary, however, where marked redness or hyperæmia may be the first change in color, and persisting to the end, usually, however, associated with more or less induration of some portion of the larynx. A localized redness of one or both cords may be among the earliest tubercular indications. Induration of some portion of the larynx makes a very early appearance, and may have its initial seat in almost any portion of the larynx. However, one of the vocal cords is generally the first part to become involved, and, although there has been an attempt to localize this first appearance of induration, we may say that it may make its first appearance almost anywhere within the laryngeal cavity. When it attacks the vocal cords they lose their normal contour, becoming somewhat rounded and nodular or flabby in character, and, if very much reddened they may at the same time lose their identity in the general swelling of the surrounding tissues. This induration of the vocal cords may be either unilateral or bilateral. The false cords or ventricular bands sometimes become involved to such an extent that they overlap and obliterate the true cords on their respective sides. When the induration involves the arytenoid cartilage a characteristic condition is established. They lose their sharply defined appearance, becoming somewhat club-shaped, and

FIG. 427. FIG. 428.



Extensive club-shaped swelling of arytenoid cartilages, with swelling of ventricular bands. (COHEN.)

when it extends to the aryteno-epiglottic ligament the infiltration presents a condition which is extremely characteristic of tubercular laryngitis. A pyramidal-shaped swelling or induration of one or both arytenoid cartilages may be taken as one of the strong pathognomonic signs of tubercular laryngitis.

In progressive cases the epiglottis becomes very much indurated, either at first or later, taking upon itself the appearance of the so-called turban-shaped epiglottis, a condition which is very characteristic of tubercular involvement, so that when there is complete induration of both the arytenoids and the epiglottis there is presented a complete characteristic circular induration at the entrance of the larynx, which is indicated in Fig. 429, involving the arytenoids, ary-epiglottic fold, and epiglottis, and when fully developed preventing an examination of the deeper portion of the larynx.

FIG. 429.

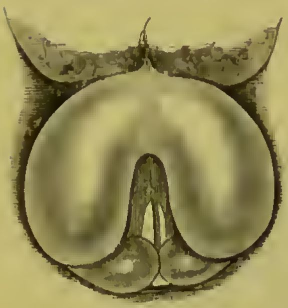


FIG. 430.

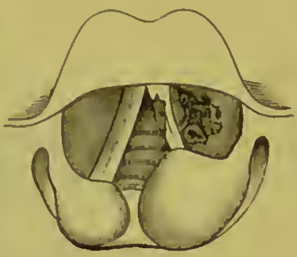


FIG. 431.

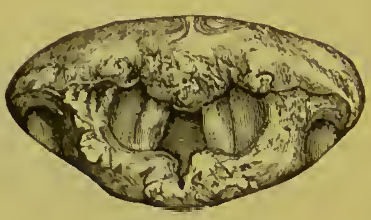


FIG. 429.—Turban-shaped swelling of epiglottis. (COHEN.)

FIG. 430.—A tubercular ulcer on the left ventricular band and left vocal cord. Pear-shaped œdematous swelling of aryepiglottic folds, more intense on the side of the ulceration. (COHEN.)

FIG. 431.—General tubercular ulceration of larynx. (COHEN.)

Ulceration in laryngeal tuberculosis is of constant occurrence and usually present at some stage of the disease. The ulcers may vary in size from the very small to those covering quite an extensive area, they may be single or multiple, limited to one side or portion of the larynx, or they may be bilateral or indiscriminate in their situation. There is no absolute positive diagnostic difference between tubercular ulcerations and those from other causes, other than possibly tubercular ulcerations may be more superficial in character, have less indurated edges, and are, as a rule, less deeply destructive in their nature. If the ulceration has existed for some length of time and is slow in its progress and not extensive in character, when taken in connection with other symptoms of tuberculosis, it is probably of a tubercular nature. When isolated they are generally surrounded by a red outer border, shading off sometimes into the surrounding tissue, and are frequently depressed, and if large in extent the ulcerating centre may present a sunken papillary condition, and sometimes the inner edges may be gray or white. When situated over a large area of broken-down induration the surface of the ulcer presents a very uneven character. In this connection it may be said that sometimes we find a loss of the vocal cords which seem to have disappeared more by a process of absorption than ulceration, with practically no symptoms of ulceration having previously been present. It is not infrequent to find the summit of smooth indurations dotted with fine ulcerations, which is quite a characteristic appearance, and it is also not unusual to find the whole surface of the true and false cords together in a state of ulceration; and frequently we find the whole surface of one or other of the arytenoid cartilages considerably destroyed by this ulcerative process, and, on the contrary, it is not uncommon to find the typical swelling of the arytenoids to exist for a long time, even through the entire period of the disease, without breaking down into ulceration. The epiglottis is frequently ulcerated in the same characteristic manner, the ulcerations attacking almost any portion of it. There is sometimes quite a marked destruction of the epiglottis by this ulceration.

FIG. 432.

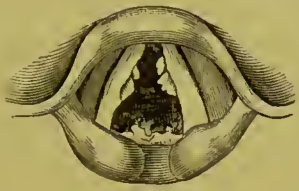


FIG. 433.

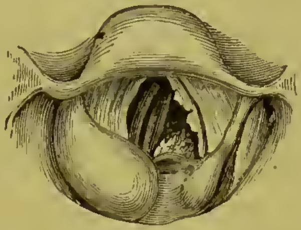


FIG. 432.—Tubercular infiltration of the interarytenoid space with tubercular papillomata of both vocal cords. Characteristic œdematous infiltration of the aryepiglottic folds. (COHEN.)

FIG. 433.—Tubercular ulceration of left vocal cord, with swelling of right arytenoid cartilage. (COHEN.)

FIG. 434.

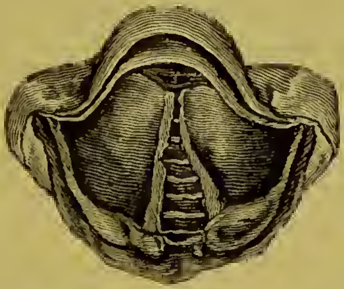


FIG. 435.

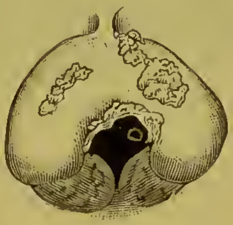


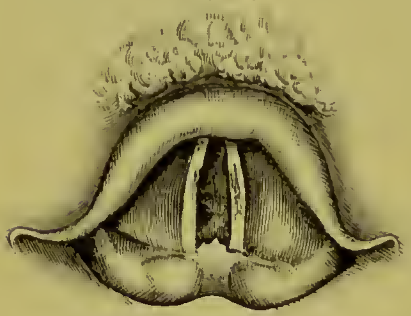
FIG. 434.—Swelling and hyperæmia of ventricular bands with ulceration of true cords. (COHEN.)

FIG. 435.—Superficial ulceration of summit and free border of indurated epiglottis. (COHEN.)

Instead of presenting a red or angry appearance, it is not uncommon to find but little change in color over the whole ulcerated area, the whole surface of involvement giving the appearance of an unhealthy anæmic or sodden condition. Perichondritis of the cartilages of the larynx may supervene from the extension of the ulceration, especially of the arytenoid cartilage, in some instances resulting in expulsion of a portion of the cartilage. The perichondrium in some instances may become primarily affected in the tubercular process, and not necessarily the result of an extension from the superficial ulceration.

Aside from the conditions included in the typical form and course of tubercular laryngitis there are other forms of tubercular involvement of the larynx, generally manifested by localized indurations or infiltrations. These infiltrations or indurations may occur as the only lesion, and may be situated at any point within the larynx; they do not of a necessity become ulcerated, but may be classed as the indurated form of tubercular laryngitis. They are quite frequently seen about the arytenoid region, either involving the arytenoid cartilages themselves, or appearing in the interarytenoid space, and when seen in this location are quite characteristic in appearance. These interarytenoid indurations may exist in a papillary or corrugated form, or the induration may be very large with a broad base, the apex of which extends well into the cavity of the larynx. This condition when seen in the interarytenoid space is described by some authors as pathognomonic of tubercular laryngitis. This is not invariably so, because it is not infrequent to find simple papillary corrugations within the arytenoid space which are apparently benign in their character; but it must be said that a *decided* induration in the interarytenoid space, which projects well into the cavity of the larynx, is very significant of tubercular involvement, even when it is unassociated with other lesions. These localized indurations may also appear on the true and false cords.

FIG. 436.



Intra-arytenoid thickening; ulceration of cord.

Diagnosis. The diagnosis of tubercular laryngitis, when dependent upon the lesions themselves, is often a difficult problem, there being no absolute characteristics to distinguish them which are not present in other forms of laryngeal ulcerations, unless it be the typical form of uniform induration involving the arytenoids and the epiglottis, and in almost all instances we must look for confirmation of our diagnosis either by the general progress of the disease, its association with general pulmonary tuberculosis, by the microscopic examination of the tissues, or by the finding of the tubercle bacilli in the expectoration or scrapings, and we might add by the tendency to fatal progress of the disease, despite all our efforts at treatment. The conditions to be differentiated from tuberculosis of the larynx are syphilis, carcinoma, and lupus, which will be considered in detail under their respective heads.

Mixed Lesion. Instances of association or mixed lesions of tuberculosis of the larynx with tertiary syphilis, having characteristics of both, have been described by some writers; but it is a condition so difficult of differentiation (if, indeed, it does exist, which is gravely doubted by the author), that it cannot be well described, and can only be determined by exclusion in the process of treatment and course of the disease. It is very rare, indeed, to notice this mixed lesion in other portions of the upper respiratory tract, and if it did exist we would expect to find it in other regions as well as in the larynx.

Treatment. The treatment of tubercular laryngitis is both constitutional and local. For the former the reader is referred to works which pertain to general tuberculosis, as it may only be said here that all local treatment should be supplemented by some form of general treatment. In some forms of early tubercular laryngitis, where the larynx is not seriously involved, a residence in a proper climate may suffice to cure or keep in abeyance the laryngeal symptoms in connection with the general improvement in the pulmonary condition.

LOCAL TREATMENT. Local treatment of tubercular laryngitis should have these ends in view:

1. Topical applications for the purpose of ameliorating local discomfort, cough, pain, dysphagia, and the accumulation of mucus.
2. Curative measures, with a view to the eradication or healing of the tubercular lesion.

The principles involved in the above are the same in their application to any portion of the upper air-tract which may become involved in the tubercular process, and the choice and mode of procedure must depend upon the location and character of the individual case under observation.

We must remember that treating a tubercular larynx is often a very delicate procedure requiring all the tact and skill we can bring to bear. Frequently the patients are in a weak bodily condition, and their throats are rendered very sensitive, adding greatly to the difficulty of manipulation.

Under the first heading of local treatment, cleansing of the parts should form a prominent feature, both for the comfort of the patient and for the proper application of subsequent measures. Where there is much secretion I know of no better means than the application of peroxide of hydrogen, which should be used with an atomizer and diluted from four to six times. This will have the effect of disintegrating the secretions, and they may be further dislodged by the patient in clearing the throat and coughing. In order to perfect the cleansing the peroxide should be followed by the use of some one of the more common cleansing and antiseptic solutions, the Dobell or Seiler solution answering the purpose, in order to completely clear the mucous membrane.

Before making any application whatever I think it a wise precaution to precede their use by a spray of ½ per cent. solution of cocaine in order to render the mucous membrane less sensitive to the subsequent applications. If there be considerable hyperæmia, a solution of adrenalin chloride may be added, so as to make a strength of 1:3000 to 1:5000, with the cocaine solution. The effect of this combination is very grateful to the patient in reducing irritability, sensitiveness, and rendering all after-application much easier of accomplishment.

Pain and Dysphagia. Cocaine in strengths varying from 2 per cent. to 8 per cent. solution, in conjunction with adrenalin, is perhaps the best means for allaying the pain and dysphagia, to be applied immediately before eating. Care should be taken that the cocaine habit is not formed by its continual use. In some cases constitutional symptoms of cocaine-poisoning may interfere with or preclude the use of the drug.

Orthoform. When there are ulcerations, causing pain and dysphagia, marked relief is produced by the use of orthoform, either in the form of powder insufflations or an egg emulsion with or without menthol (12 per cent.), as suggested by Freudenthal,[1] of New York, to be applied with an ordinary cotton applicator or by means of a laryngeal syringe. The advantage of orthoform is that it is non-poisonous, and its effects last longer than cocaine, although it is slower in beginning its action.

Ethyl Chloride. The author has obtained excellent effects from the local anæsthesia produced by ethyl chloride, notably in the pharynx and at the base of the tongue, when its application is made easy by the glass tube manufactured for that purpose—for local anæsthesia. Its effect is not very lasting.

Intralaryngeal and Tracheal Injections. As a means of applying local remedies directly to the larynx and trachea, I am fully convinced, both for curative and for purposes of local amelioration, we have in intralaryngeal and tracheal injections with a properly constructed syringe one of the most efficient means at our disposal. The larynx becomes gently and thoroughly bathed with the solution, and it exercises its local influence as it passes down and is absorbed in the trachea and bronchi, thus producing a constitutional absorption as well. The number and character of the solutions that may be employed, either oily or aqueous, are numerous, and may be chosen to meet the indications demanded. The effect in relieving cough, local pain, dysphagia, and producing a general comfort of the patient is sometimes very marked. The injections should be preceded by local anæsthesia, and after the details become mastered the production

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[1] Journal of the American Medical Association, March 16, 1901.

I append the formula of the orthoform emulsion as suggested by Freudenthal, with directions for its use. It may be used without menthol, if so desired.

"In all irritations of the larynx menthol is of excellent service. It relieves the cough, and with this much of the secretion. This is the reason I added menthol to the above emulsion. I use the following:

" Menthol,		1, 5, 10, or 15	
Ol. amygdal. dulc.,		30	
Vitelli ovorum,		25	
Orthoformi,		12	5
Aquæ dest.,	q. s. ad.	100	

Ft. emulsio.

"I commence with 1 per cent. menthol in this emulsion, and as quickly as the toleration of the patient permits I increase it to 10 per cent., and it has been in the rarer cases only that I have used 15 per cent. menthol."

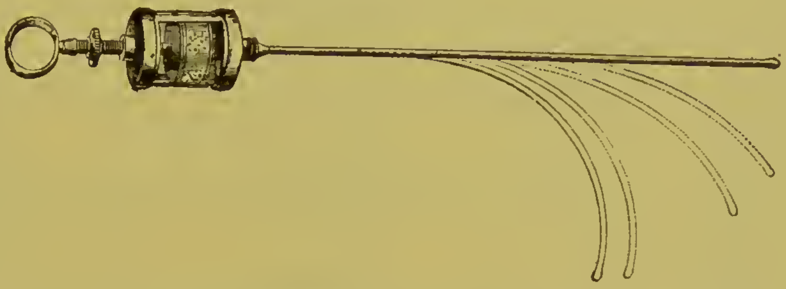
of any irritation is reduced to a minimum and the procedure becomes well tolerated by the patient.

Dysphagia may become so extreme that it may be necessary to resort to artificial feeding through a stomach tube, and in some instances fairly comfortable swallowing may be attained in the so-called "Casselberry" position, being the method used in feeding during intubation.

CURATIVE MEASURES. Under this heading are included local applications to the surface of the lesion, and the direct eradication by means of more decided surgical measures.

The list of local remedies is, indeed, a very long one, each having its advocates, and most excellent results having been reported with all of them. A detailed description of their respective merits would carry us too far in an article of this length, and we will content ourselves with their enumeration, a partial list, including iodoform, europhen, menthol in oily solution, creasote, guaiacol, ichthyol, parachlorophenol, sulphoricinate of phenol, enzymol, iodol, aristol, camphor-menthol, and also lactic acid directly to the ulcerating surface or in combination with curettement, to be spoken of later. The author has seen most beneficial effects from the application of lactic acid to the surface of the ulceration, even without curettement, and, perhaps, there is no one remedy which will give better results when judiciously employed. The lactic-acid treatment was first introduced by Krause, who advocates rubbing it in thoroughly on the ulcerating surface by means of a laryngeal cotton applicator or injecting it by hypodermic syringe into the deeper tissues of the ulceration. One may begin with a 10 per cent. or a 20 per cent. solution, increasing it to 75 per cent., or to full strength. It may be employed daily or every other day at first, diminishing the intervals as the caustic action followed by cicatrization show themselves. The parts should be thoroughly cocainized prior to the application of the lactic acid.

FIG. 437.



Syringe used for intralaryngeal and tracheal injections of both aqueous and oily solutions. (MUIR.)

Of the intralaryngeal surgical measures may be mentioned curettement, as advocated by Heryng and Krause, either by itself or in conjunction with the rubbing in of lactic acid over the curetted surface, and the excision of tubercular indurations and infiltrations by means of cutting forceps, as recommended by the above surgeons, with instruments bearing their name.

We are indebted to Dr. Gleitsmann, of New York, more than to any other American writer, for a full exposition of the subject of intralaryngeal surgical treatment, and the reader is referred to his most excellent article read before the American Laryngological Association, 1895, and found in the *Transactions* of that society for that year, and published as well in the New York *Medical Journal*, October 19, 1895. He enters most especially into the discussion of the merits of and indications for curettement of tubercular ulcers and excision of indurations as carried out by Krause and Heryng, with descriptions of the instruments used by these surgeons, and summarizes the indications and contraindications as follows:

"When summarizing the indications for curettement, it is to be recommended:

"1. In cases of primary tubercular affections without pulmonary complication.

"2. In cases of concomitant lung disease, which is either in the incipient stage or has at least not progressed to softening and hectic conditions.

"3. It is best adapted for circumscribed ulcerations and infiltrations of the larynx.

"4. For the dense, hard swelling of the arytenoid region, the ventricular band, the posterior wall, for tubercular tumors, and for affections of the epiglottis.

"5. In advanced lung disease, with distressing dysphagia resulting from infiltration of the arytenoids, curettement is justifiable as the quickest means to give relief.

"Contraindications are:

"1. Advanced pulmonary disease and hectic.

"2. Disseminated tubercular disease of the larynx, leaving little or no area of healthy tissue.

"3. Extensive infiltrations, producing severe stenosis when tracheotomy is indicated.

"We will also not recommend surgical treatment to nervous distrustful patients who lack the necessary perseverance or confidence in their physician. On the other hand, it is often surprising how willingly patients, knowing their precarious condition, submit to the operation, how cheerfully they permit the necessary manipulation when the physician, guided by purest motives, devotes his best energies to the relief of the sufferer."

For curetting or scraping of an ulcerated surface the single curettes of Heryng are used, while for excision of infiltrated areas the double curettes of Heryng and Krause are indicated. These latter instruments should more properly be called excision forceps.

In performing the operation of curettement or excision the parts should be thoroughly cocainized with a strong solution either by spray, cotton-applicator, intralaryngeal syringe, or curved hypodermic syringe into the tissue substance. In order to prevent hemorrhage, which is sometimes troublesome, we have a most valuable agent which renders the procedure practically bloodless in a 1:5000 solution of adrenalin chloride applied in the same manner, either alone or in combination with cocaine.

Inflammatory action sometimes follows the operation, which must be met by the ordinary means applicable to laryngeal inflammation. We may suggest the external application of ice and laryngeal spraying with adrenalin.

FIG. 438.

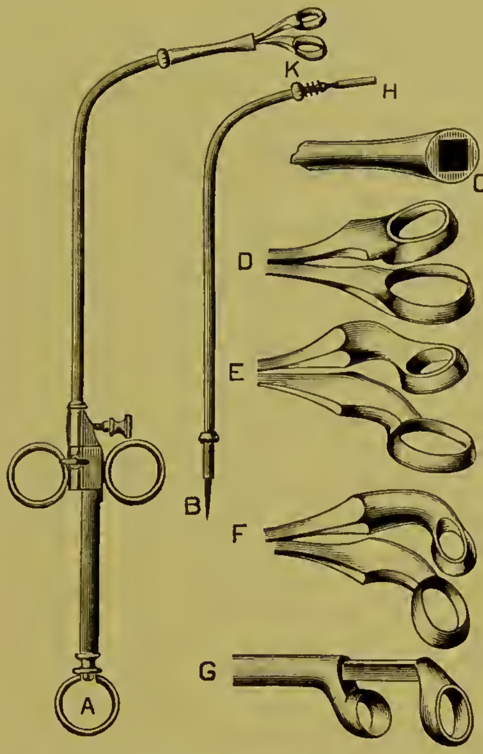


FIG. 439.

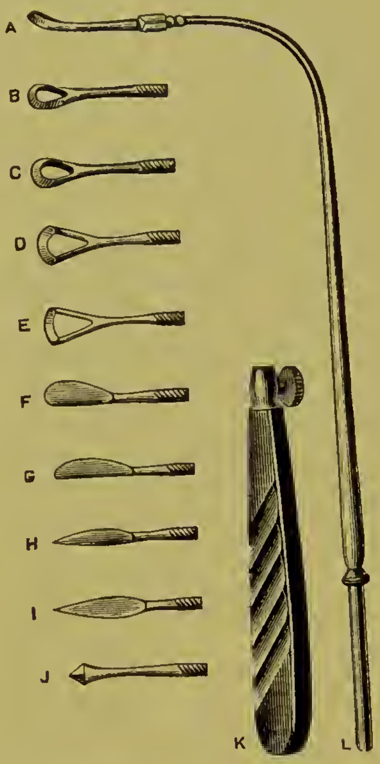


FIG. 438.—Double rotary curette of Heryng. A. Instrument complete, ready for use. B. Canulated shaft, with handle and curettes detached. K. Thumb-screw. C. Attachment with rectangular opening. This is attached at K. D, E, F. Double curettes which fit into the rectangular opening C. This rectangular opening prevents the curettes from twisting out of proper coaptation, and by rotating C on the canula the curette can be set at any desired angle. G. Curette for ventricular band. The instrument is in reality an excisor forceps and not a curette. (GLEITSMANN.)

FIG. 439.—Set of Heryng's knives and curettes.

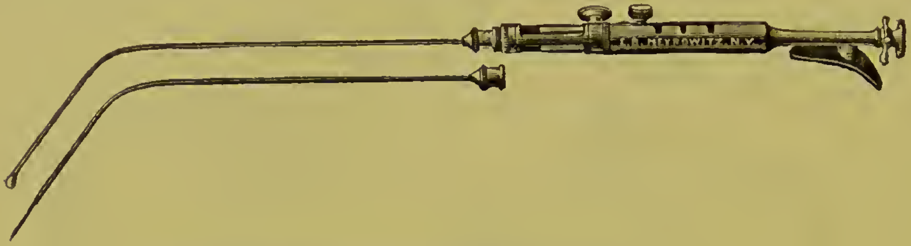
SUBMUCOUS INJECTION. This method, both with lactic acid and with creasote, has been practised with considerable success, the latter substance being highly extolled by Chappell, of New York, who uses it superficially and by deep injections into the substance of the indurations with a specially constructed syringe and needle. The combination he uses is:

Creasote (beechwood),		
Olei gaultheriæ,	āā	ʒij.
Olei hydrocarbon,		ʒj.
Olei ricini,		ʒiij.

The proportion of creasote may be changed to meet the varied conditions.

Incisions. I can only look upon incisions into the infiltrated areas as practised by Moritz Schmidt as being of service in depletion, and especially where there is œdematous tissue present, although radical results have been claimed.

Fig. 440.



Chappell's syringe for submucous laryngeal injections. (Meyrowitz.)

Galvanocautery and *electrolysis*, although having some advocates, are not extensively practised, the former, unless used very carefully and in selected cases, being apt to be followed by severe reactionary results. The latter is difficult of application and slower in its final effects, especially over any extended area.

Tracheotomy is used when severe stenosis is present, and also with the idea of giving rest to the larynx in severe advanced cases. It is a peculiar fact that however severe may be the laryngeal involvement in tuberculosis, it rarely produces sufficient stenosis to call for relief by tracheotomy.

Intubation can be recommended only to meet a sudden emergency of suffocation, as the constant pressure of the tube in the larynx would cause pain and ulceration, and would not be well borne.

Prognosis. Although considerable progress has been made in the treatment of laryngeal tuberculosis, and the disease has undoubtedly been arrested in certain cases, especially in the indurated type and in *localized* tubercular growths and ulcerations, and, although even when there has been extensive involvement of the larynx in advanced general tuberculosis, the local symptoms have been ameliorated and a certain degree of comfort afforded the patient, we cannot but admit that the general prognosis is very bad, and, as a rule, we must look upon the involvement of the larynx as indicating an extension and progress of the tubercular process which will ultimately end in the death of the patient.

There are no positive means by which we can say how long a patient will live after tuberculosis of the larynx has manifested itself, and the immediate prognosis depends greatly upon the type of the involvement, the condition of the pulmonary involvement, and the resistance to the disease offered by the individual patient. The chances for the extension of life and the arrest of the tubercular process by treatment are undoubtedly better where we have to deal with a purely localized condition. All this should guide us in the choice of treatment, and should make us utilize every possible means at our disposal to bring about a favorable result, for it is undoubtedly true that although the process is indicative of a fatal termination, much relief can be gained by judicious treatment.

As to figures we might quote from John N. Mackenzie, who deduced the fact that from 100 cases death resulted in from twelve to eighteen months after the usual symptoms showed themselves, and that in 6 per cent. a fatal issue occurred within six months. Bosworth[1] gives forty-six months as the longest time, and three months as the shortest time after pulmonary tuberculosis was complicated by laryngeal invasion, or, to quote his summary: "The average duration of life in an ordinary attack of pulmonary consumption is three years, the average duration of life in an attack of pulmonary consumption complicated by laryngeal invasion is two years, and the average duration of life after the supervention of laryngeal invasion is eighteen months."

LUPUS OF THE NOSE AND THROAT.

Two salient points are always to be thought of in the general consideration of lupus of the upper air-tract: first, it is practically always secondary to or associated with lupoid manifestations of the skin, generally of the face, and, second, it should be viewed as a tubercular lesion. As to these two points, by far the greater number of investigators concur. Rare instances of primary lupus of the pharynx and larynx are claimed by some, and in support of its existence the subject has received an extensive consideration by Emil Mayer, of New York,[2] who reports in detail two cases of his own, and refers to others collected by Rubenstein.

The question of the tubercular nature of lupus apparently is so thoroughly proven by the finding of the tubercle bacilli that it is suggested by some authorities to dispense altogether with the term lupus as it pertains to the larynx. While from a bacteriological standpoint the relation between lupus and tuberculosis is apparently identical, still we cannot but be impressed with the great difference in the clinical course of the two lesions. Tuberculosis in almost every form is more or less rapid, is associated with pulmonary lesions, gives rise to more pain, is progressive, and ends fatally, with some associated tubercular concurrence. Lupus, on the other hand, is very slow and insidious in its development, not necessarily associated with pulmonary tuberculosis, gives a minimum amount of local discomfort, has a tendency to heal, cicatrize, and recur, and often does not result in death from pulmonary involvement.

Lupus of the nose is so associated with the contiguous skin lesion that the reader is referred to works on dermatology for its description.

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[1] Twentieth Century Practice.

[2] New York Medical Journal, January 1, 1898.

Pharynx and Larynx. Relative to its frequency H. Mygind,[1] in an examination of 200 patients with lupus of the skin, found the larynx affected in 10 per cent. of the cases. Fifteen of the laryngeal cases were females and five males. Hunt,[2] in a tabulation of 411 cases of external lupus, found either the pharynx, larynx, or nose involved in 20 per cent. of the number. In 173 cases of lupus of the mucous membrane occurring in the clinic of Doutrelepont only 6 cases were free from cutaneous lesions, and of this same number 75 cases were affected in the nose, 31 cases in the palate, and 13 cases in the larynx. Females are more often affected than males, and the lesion is more apt to show itself before puberty.

Symptoms. The subjective symptoms at first are not very prominent, which is a characteristic point; it is only when the lesion has existed a long while, causing symptoms from destruction or stenosis, that our attention is particularly arrested.

Appearance. The appearance of the lupus varies according to the progressive stages of the lesion, the characteristics being the same as it affects either the pharynx or larynx. When the uvula or soft palate is involved there are produced in consequence, first, a tumefaction somewhat reddened in color, followed by the formation of nodules over the area of the induration, variable in size, and when dense and confluent producing a distention of the uvula and soft palate, this nodulation being followed by ulceration and subsequent cicatrization. The whole process of ulceration seems to be a successive breaking down of these nodulations, which in turn may heal as new nodules appear.

Larynx. When the larynx becomes involved the disease usually makes its first appearance on the free margin of the epiglottis, causing, in some instances, a considerable amount of destruction before invading the interior of the larynx; this feature of limiting itself for a long while to the epiglottis is a valuable point in the diagnosis between lupus and other long-standing destructive lesions.

The appearance of laryngeal lupus is well described by Breda, as follows: "The epiglottis is thickened and irregular at its free border, with slightly raised pale or grayish-red eminences. These we may observe to become white at their apices, a slough forming which, on separating, leaves a small ulcer with sloping edges and grayish-yellow base, but without any surrounding hyperæmia or infiltration of its margin. These ulcers are slow of healing, and as one cicatrizes another nodule breaks down or is absorbed without ulcerating. In this way a worm-eaten appearance is given to the edge of the epiglottis, which is very characteristic of the disease. As the process goes on the epiglottis becomes paler until it comes to have a dead-white color and to the probe is stiff, fibrous, and resistant. Stenosis of the larynx only rarely results from lupus, and may be due to blocking of the larynx by lupoid tissue, to fixation of the vocal cords, or contractions resulting from cicatrization. It is remarkable how seldom tracheotomy is required in lupus."

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[1] Archiv f. Laryngol. u. Rhinol., Berlin, vol. x. Part I.

[2] Watson-Williams, 4th ed.

Diagnosis. The diagnosis lies between tuberculosis, carcinoma, sarcoma, and syphilis; it is perhaps from some forms of the latter that differentiation is the most difficult.

Treatment. Though the disease is a slow progressive one, there is a tendency in some instances to a spontaneous arrest which may remain for some time, to be followed by a recurrence. Local treatment is mainly that of escharotics and surgical procedures. Lactic, carbolic, and chromic acid, with galvanocautery and other caustics have been employed, while incisions, curettement, and excision are the surgical measures indicated. Watson-Williams mentions the efficacy of submucous injection of tuberculin, and refers to the possibilities of the employment of the X-rays.

LEPROSY OF THE NOSE AND THROAT.

Leprosy of the upper respiratory tract in this country is an extremely rare disease, and whenever occurring is always secondary to leprosy of the skin—never a primary disease. It may attack the mucous membrane of the nose, pharynx, or larynx, and should be suspected when these parts become involved by marked structural changes during the course of general leprosy. The subjective symptoms at first are very mild, mainly those of irritation. The structural changes follow the order of congestion, tumefaction, tubercles, and ulceration. The progress is slow and intermittent, and treatment is by the application of caustics and surgical removal.

The reader is referred to a most complete and exhaustive description of the disease by Dr. Ramon de la Sota y Lastra, in Burnett's *System of Diseases of the Ear, Nose, and Throat*, vol. ii.

STENOSIS OF THE LARYNX AND ITS TREATMENT.

Stenosis of the larynx may be either acute or chronic. Generally speaking, acute stenosis is regarded as that type seen in the diphtheritic croup of children which has been considered under the subject of diphtheria. We are wont to classify other forms as chronic, adult, or non-membranous stenosis. The classification of Dr. Asch[1] of the causes of laryngeal stenosis serves as a most excellent one in the consideration of the subject, viz.:

1. Cicatrices following the healing of ulcers, or the formation of bands abnormally uniting different parts of the larynx, as the result of constitutional disease, syphilis, phthisis, glanders, wounds, or burns.

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[1] Buck's Handbook of Medical Science, vol. iv.

2. Inflammations, acute or chronic, resulting in obstruction of larynx, croup, diphtheria, œdema, and perichondritis. Chronic stenosing inflammations are also alluded to under this head.
3. Neoplasms, benign or malignant.
4. Neuroses causing spasms or paralysis, asphyxia.
5. Compression of the larynx from external causes, which includes fracture of the larynx.

Symptoms. The symptoms of stenosis are those of impaired voice and laryngeal breathing, mechanically produced by the stenosing cause, the severity depending on the extent to which the passage of air through the larynx is impeded. The symptoms may be progressive or come on suddenly. The exact nature and extent of the stenosis can only be determined by laryngeal examination, which is an absolute necessity in determining the mode of relief.

Treatment. The treatment of laryngeal stenosis naturally resolves itself into, first, *constitutional*, as indicated principally in cases of syphilitic stenosis, by the administration of potash and mercury; second, *mechanical*, the exact form depending on the seat, nature, and extent of the stenosis. Under mechanical treatment may be included:

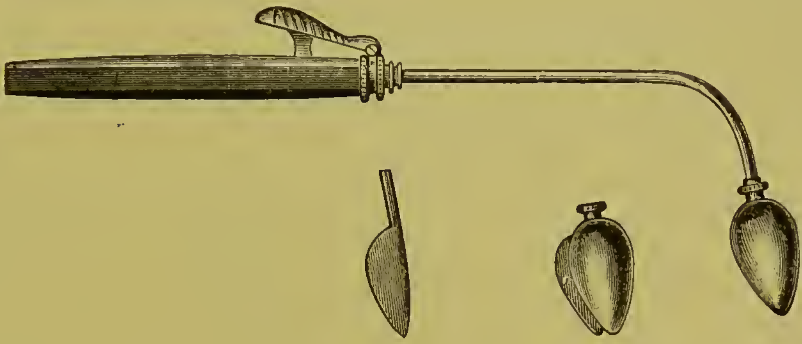
1. Surgical removal, by external or endolaryngeal measures, of stenosing growths, the liberation of binding cicatrices, web-like bands, etc.
2. Tracheotomy or intubation for the immediate relief of impending suffocation.
3. Some forms of dilatation, either as a single measure or in conjunction with tracheotomy.

The surgical removal of stenosing growths and the performance of tracheotomy or intubation for immediate relief are measures which each instance will suggest, and need no further description either for their indication or manner of performance than has been accorded them under their respective chapters.

The subject of dilatation of laryngeal stricture has received the attention of laryngologists for many years, the procedures being based on the same general lines as in tubal strictures of other portions of the body. Principal among those whose names are early associated with the subject are Schroetter, whose dilating tubes and metallic plug required a preliminary tracheotomy in order to be retained in the larynx; Morell Mackenzie, whose screw dilator was introduced like laryngeal forceps, the dilatation being accomplished by means of a screw at the proximal end of the instrument; Whistler, whose cutting dilator, the portion entering the larynx, consisting of an olive-pointed plug with a concealed knife, was principally used for the purpose of dividing bands or webs and obtaining some dilatation at the same time; Navratil, whose dilator, consisting of a four-sectioned olive-shaped plug, is introduced closed, and dilated by means of a proximal screw. These and other instruments based on the same principles obtained a measure of success in certain adaptable cases:

but they were all open to the two positive objections either of requiring a primary tracheotomy or necessitating oft-repeated short attempts at dilatation. The nature of laryngeal stricture is such, together with the resisting quality of the laryngeal box, that, in order to produce proper dilatation something must be introduced within the larynx which will remain there an indefinite time, producing continuous pressure, and, if possible, allow breathing to be carried on through the larynx without the aid of tracheotomy.

FIG. 441.



Whistler's cutting dilator.

It was not until the principle of laryngeal tolerance was proven by the late Dr. Joseph O'Dwyer, of New York, by his method of intubation as applied to diphtheritic croup, that these latter barriers to permanent intralaryngeal pressure were overcome, and we can say without much fear of contradiction that the present-day treatment of laryngeal stenosis, whatever its nature, consists in the application of the principles of intubation.

So strongly imbued was Dr. O'Dwyer himself with his belief in the success of intubation for this purpose that he said:[1] "Had intubation of the larynx proved a complete failure in the treatment of croup I should still feel amply repaid for the time and expense consumed in developing it, for I believe that it offers the most rational and practical method yet devised for the dilatation of chronic stricture of the glottis." Subsequent results have, in my experience, substantiated Dr. O'Dwyer's belief.

The indications for intubation in laryngeal stricture may be classified as follows:

1. Gradual stenosis of a more or less long-standing nature, not of a necessity, however, demanding an immediate operation.
2. Acute stenosis calling for immediate relief, either primary in its nature or an exacerbation of an already existing condition.
3. Where we wish to produce sufficient dilatation to dispense with

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[1] New York Medical Journal, March 10, 1888.

the wearing of a tracheal canula, thereby establishing respiration through the normal channel.

These three groups are not arbitrary in their division, and one may at times merge into another, especially as far as the first and second are concerned, for we *must always remember that all cases of laryngeal or tracheal stenosis, however gradual, may, at any moment, take upon themselves a sudden exacerbation.*

Before going further into any detailed discussion of the adaptability of intubation in the foregoing types of cases, and the principles guiding the performance of the same, let me say that the fundamental underlying consideration which should always guide us is a *proper diagnosis.* This cannot be too strongly emphasized, for I think that the failures and the disappointments which may have overtaken us have been largely due to a lack of appreciation of the exact nature of the case in hand. This discrimination includes, among other things, not only an appreciation of the original cause, but also the nature and location of the swelling, density of the tissue involved, whether or not there be ulceration, and whether the immediate condition of the patient is such as to permit of the extra exertion necessary for a proper operative manipulation. No one for a moment should think of performing intubation without a previous laryngeal examination, and if a complete examination cannot be made and we cannot come to a fairly accurate conclusion as to both the cause and nature of the obstruction, the operation should give way to tracheotomy, with a view to using intubation subsequently. Bearing on this point is another important consideration, that of always being prepared to do a tracheotomy in the event of failure of intubation.

It is in the second class of cases where intubation in comparison with tracheotomy is put to its severest test, and those of us who may be its strongest advocates must not be so much prejudiced in its favor that we cannot see its impracticability in certain cases, remembering that no one operation is without its limitations.

It goes without saying that in the second class of cases, where we wish to choose between intubation and tracheotomy, that intubation should be chosen if applicable, thus avoiding the cutting operation; but the decision should be made only after due consideration of all the contingencies.

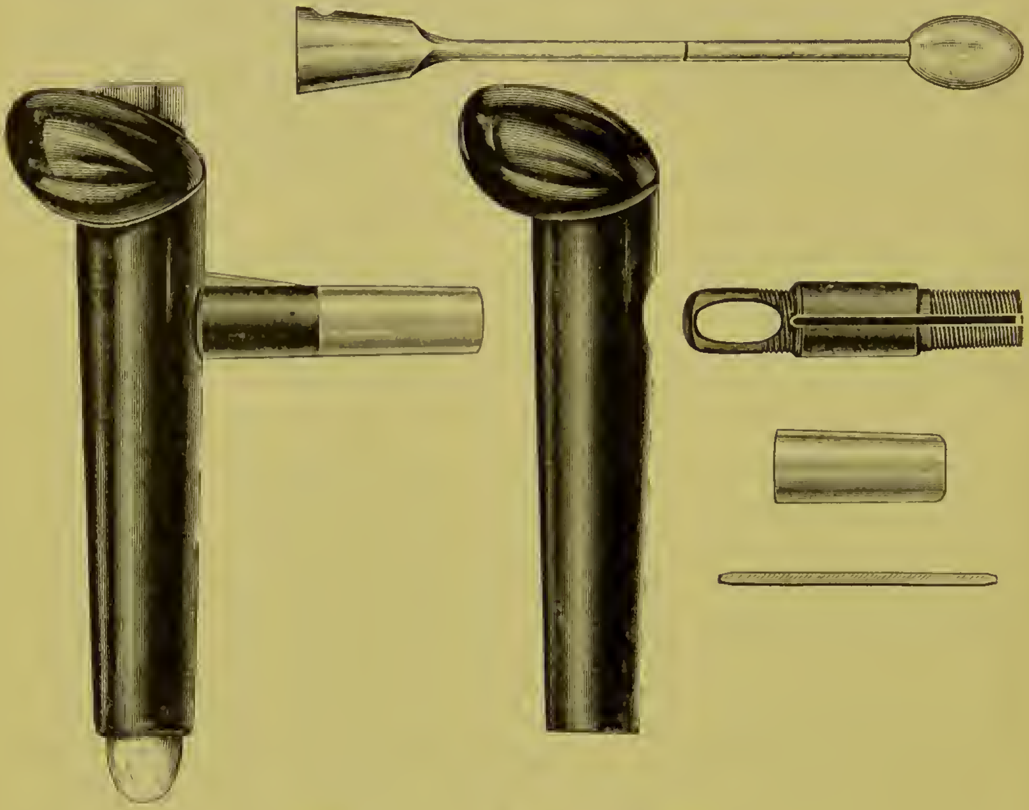
Perhaps it is in the third class of cases, namely, where we wish to dispense with the tracheal canula, that intubation has its most positive application in adult stenosis, being closely allied in this respect to the first class. It is here that we come into direct comparison with the other and older methods of dilatation. An intubation tube has the advantage of being tolerated in the larynx for an indefinite length of time, thus producing a constant degree of absorbing pressure, which is the main point to be gained, and there is an opportunity offered for altering the size and conformation of the tubes to meet the changing conditions. It has been proven by many cases that an intubation tube *may* be worn indefinitely with a comparative degree of comfort, the patients, in most cases, learning to adjust themselves to the new method of breathing.

With the tracheotomy tube *in situ* we have ample time and opportunity to study the shape of the stenosis and to make sufficient trial with various sized and shaped tubes, and this with the minimum amount of suffocation or exhaustion. It may be feasible in the beginning to make an explorative introduction with either a Schroetter tube or a laryngeal sound of some kind; but I have always held and still do hold to the opinion that if a Schroetter tube can be passed an intubation tube of the same or larger calibre can be as well passed and be retained, when we then get the advantage of a continued pressure without subjecting the patient to repeated and ofttimes ineffectual attempts at permanent dilatation. It is frequently the case that intubation cannot be performed as the primary operation, and we must depend on it only for secondary dilatation after the performance of tracheotomy. Under these circumstances it is well to perform the tracheotomy as high up as possible, as it is much easier for the subsequent introduction and retention of the intubation tube than when the tracheal opening is low down and possibly beyond the reach of the end of the intubation tube. Intubation should be performed as soon as possible after the tracheotomy, in order to avoid the secondary stricture, which is liable to occur at the superior margin of the tracheotomy wound, which sometimes has to be overcome before the intubation tube can be properly introduced. The longer a tracheotomy tube remains in an adult larynx the more difficult does it become to reach the larynx with the guiding intubation finger and tube, as the tracheotomy prevents the larynx from rising on phonation; this difficulty is increased in a very small patient, where the larynx is naturally beyond the control of the introducing finger.

One of the former objections and perplexities of intubation in adult cases was the uncertainty as to the retention of the tube for any length of time, and the probability of its being ejected in a fit of coughing; this objection, however, has been satisfactorily met by the recent suggestion and modification of Dr. John Rogers, of New York (Fig. 442), consisting of a retaining arm which is screwed at right angles in a threaded opening in front of the intubation tube, at the site of the tracheal opening. It is prevented from unscrewing while in position by having a small plug or pin inserted in a groove on the upper surface of the arm. Thus the tube is easily retained, resisting all efforts at expulsion, and at the same time the supplementary device may be easily removed at the will of the patient or operator, and the tube subsequently removed in the usual manner. It might be thought at first that there would be considerable danger from the plugging up of the tube by retained secretions, but this rarely happens in adult cases, and if there be any tendency in that direction steam inhalations may at times be used, or the tube removed from time to time for the purpose of cleansing.

The method of finding the point in the intubation tube for the insertion of the arm is as follows: The intubation tube having been placed in the larynx after the tracheotomy tube has been removed, a mark is made on the intubation tube through the tracheotomy wound, either by a fine hot stiff metal probe which burns a permanent marking, or by scratching the tube with the point of a stiff hand instrument; then the intubation tube is removed and the instrument-maker fits the threaded arm at the point of the marking. In the *Journal of the American Medical Association*, June, 1900, Dr. Emil Mayer, of New York, describes a hollow introducing handle which is continuous with the intubation tube, a most valuable device for intubation in certain cases, which has for its object the prevention of the cutting off of the air during the operation.

FIG. 442.



Rogers' intubation set for chronic stenosis.

SHAPE. The *shape* of the tube used in adult intubation is the same as that used for the relief of croup in children, only larger and longer. For general convenience, a set of three tubes will be found sufficient, viz.: a small, medium, and large size. If any special form of stenosis has to be overcome wherein the ordinary shaped tube cannot be used, it will be necessary to change the shape in accordance with the case in hand. The introducing and extracting instruments should be heavier and stouter than those used with the croup tubes, in order to permit of more force in passing the different strictures. The tube may be either of hard rubber or metal; the metal tube being heavier, is advantageous sometimes in sinking lower down in the larynx and not rising up so far in the act of deglutition. The secretions are somewhat more liable to collect in metal tubes, although it is unusual for either to become obstructed sufficiently to necessitate removal. Although there is considerable difference in the weight between the metal and hard-rubber tubes, they seem to be about equally well tolerated. The technique of intubation in the adult is, in the main, the same as when done for croup in children, and where a minimum of force is to be exerted, and where the epiglottis can be well managed by the left forefinger, the operation is comparatively easy for those who have had any experience. On the other hand, where an extra amount of force is to be exerted and where the epiglottis cannot be easily controlled, the operation becomes more difficult. We are apt to find this latter difficulty in very tall patients and in those who have worn a tracheal canula for a long while, rendering the larynx inactive.

Under certain circumstances, where the entrance to the stricture is very small or situated away from the median line, thus increasing the difficulty of inserting the tube, it may be well to try its introduction with the aid of the laryngeal mirror; but as soon as the tube enters the stricture the mirror will have to be quickly dropped and the forefinger of the mirror hand transferred to the head of the tube, to exert the proper pressure and to hold it in place while the introducing instrument is being withdrawn. Increased experience has led me to advise intubating by aid of the mirror in all cases of adult stenosis, if possible to do so. The string should be allowed to remain until we are quite assured that the breathing is easier and there is no danger of the tube becoming occluded or coughed out. Especially is this necessary where the calibre of the tube is very small. If we leave the patient with the string attached, which we can do longer in an adult than in a child, directions should be given to withdraw the tube by means of the string whenever the patient is unable to clear the tube by coughing and there is danger of suffocation. They should be cautioned, however, not to act too hastily, else it might be difficult to replace the tube, especially if there had been difficulty in the first introduction. It is well to use medicated steam inhalations in order to prevent drying of secretions in the tube. Patients differ with respect to the amount of irritation produced by the tube; but, as a rule, it becomes better tolerated day by day. The same may be said relative to deglutition which, as in children, is the most difficult feature to overcome. This difficulty, in a measure, may be obviated by having the patient swallow while lying down, with the head lower than the rest of the body, or by leaning over a chair, or by resorting to an œsophageal tube or rectal enemata, which means should be dispensed with as soon as the patient can accustom himself to swallowing in the usual way.

The removal of the tube may be accomplished with or without the aid of the laryngeal mirror. I think, however, the former way is preferable, as then we can see the point of the extractor enter the tube, thereby lessening the danger of lacerating the mucous membrane by ineffectual attempts at removal. While the tube is in the larynx examinations should be made to see that its proper position is maintained and that the opening does not become occluded by overlapping swollen mucous membrane.

FOREIGN BODIES IN NOSE AND THROAT.

The lodgement of foreign bodies in the nose and throat is of very common occurrence, the articles so lodged consisting of almost every conceivable object large enough to be retained in the various cavities. In the *nose* it generally happens in early childhood, and is the result of their being placed there, either by the child itself or by companions. When detected immediately after their introduction it becomes simply a matter of examination and removal, generally without any resulting harm, but very frequently they remain in the nose for a long while without the knowledge of the parents, setting up symptoms of obstruction, epistaxis, pain, mucopurulent discharge, and all the symptoms of a decided rhinitis. As a matter of experience, they are so generally placed in but one side of the nose that it is almost an axiom that a unilateral mucopurulent sanguineous discharge from the nose is always strongly indicative of a foreign body. When this condition is present it may be recognized on examination of the nose, when, if the foreign body is low down and not covered by swollen mucous membrane, its presence is readily determined. If, however, the suspected substance is further in it will be necessary to use a blunt metal probe, passing it well down in the inferior meatus, and then, if undetected, up into the higher nasal region, when, if present, the familiar grating sensation of a foreign body will be imparted by the probe. It is best to facilitate the manipulation of the probe by the application of cocaine. Frequently when the foreign body has resided in the nose for a long while, it may become encysted or covered with lime salts. Their removal is best accomplished under cocaine and adrenalin by means of a suitable nasal forceps, preferably one with a slightly-rounded olive point, so that the foreign body may be securely grasped around its circumference. If the substance is conveniently situated its removal may be effected by the use of a strong bent probe rather broad and in the shape of a hook. If very loose in the nose, and well down, the foreign body may be expelled by forcible blowing of the nose with the unobstructed side and mouth closed. It may be necessary in some instances to push the substance back into the nasopharynx; but I think this should be avoided if possible. While, usually, removal may be effected by local anæsthesia, it may be necessary, owing to its size, conformation, and the irritability of the child, to employ general anæsthesia.

RHINOLITHS.

In a certain number of cases foreign bodies which lodge in the nose become incrusted with the salts of the nasal secretions, the foreign body being the nucleus, and the calcareous deposit is superimposed, either in a solid mass or in layers. Sometimes on breaking the rhinolith we may find the nucleus absorbed or the cavity containing a thick secretion. This may be accounted for by supposing the original nucleus to have been a particle of hard or inspissated mucus, or a small detached piece of dead bone. Rhinoliths should be treated in the same manner as ordinary foreign bodies, as their symptoms are the same.

Foreign substances of various natures may become accidentally impacted in the *pharynx* and *larynx* in a variety of ways, particles of food and fish-bones during the processes of eating, swallowing of toothplates, pins, and nails held in the mouth in various occupations, coins, parts of toys, and other substances which children are constantly holding in their mouths.

The symptoms of impaction of the pharynx or larynx come on so quickly that the history is very easily obtained. They vary according to the location of the impaction and the nature of the foreign body which becomes impacted. In the pharynx the symptoms are generally those of pain and dysphagia, and in the larynx of pain and dysphonia, cough, excessive laryngeal irritation, and impaired breathing. Frequently if the substance be small and of an irritating nature, it is expelled by either coughing or vomiting, and the patient continues to complain with positiveness that the foreign body is still there. In some instances it is very difficult to assure the patient that the foreign body has been expelled. The exact location and nature of the impacted substance can only be definitely made out by a proper examination in the upper pharynx, by depression of the tongue and the use of the postnasal mirror, and in the lower pharynx and larynx by the use of the laryngeal mirror, or possibly by the application of the X-rays. The treatment of foreign bodies impacted in those localities will depend upon their nature and seat of impaction. If it is impossible to eject them by means of coughing, vomiting, or by inversion of the patient, it will be necessary to resort to instrumentation. This may be brought about in the upper pharynx by depression of the tongue and the use of strong, properly-shaped forceps. In the lower pharynx and in the larynx it will be necessary to use endolaryngeal forceps suitable to reach the desired object. If the exact nature of the object can be easily determined, it is a very wise precaution to try the forceps on an object of the same or similar nature, so as to be sure that the forceps will properly hold any engaging object in the throat and prevent slipping. This is especially important if the object be impacted within the larynx. Both the examination and the instrumentation should be done under the influence of a thorough cocainization. This not only makes the extraction of the foreign body much more easy, but it also will allay the irritation caused by the impaction. If the character of the object is definitely known and is lodged in the subglottic region, the use of the O'Dwyer short, cylindrical foreign body intubation tubes may be brought into requisition.

The value of utilizing the method of direct laryngoscopy as instituted by Kirstein has been mentioned as affording assistance in the search for and removal of foreign bodies in the trachea. This method when practicable would seem to possess considerable advantage. Instances have been reported by Ingals,[1] F. K. Hamilton,[2] and others.

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[1] New York Medical Journal, September 17, 1898.

[2] Australian Medical Gazette, May, 1898.

CHAPTER XX.

NEOPLASMS OF THE NOSE AND LARYNX; THE LOCAL, MEDICINAL, AND SURGICAL TREATMENT OF THE LARYNX.

By W. E. CASSELBERRY, M.D.

NEOPLASMS OF THE NOSE.

Benign Neoplasms, Nasal Polypus (Œdematous). Œdematous nasal polypus is a tumor of a gelatinous consistency, more accurately described as œdematous fibroma, which originates from the mucosa or mucoperiosteum in consequence of chronic inflammation, especially of the ethmoid region. It is sometimes designated as myxoma; but it is not identical with that neoplasm, as it occurs elsewhere, and it differs from it in histogenesis.[1] The form, aspect, and consistence of a polyp has been likened to a grape-pulp, but scarcely with accuracy. The natural shape is pyriform, but this is often varied by pressure. When small it is sessile; but it becomes pedunculated by gravity as development proceeds, and the point where the pedicle is confounded with the tissues of attachment is known as the "root." The color varies according to vascularization, from a yellowish-blue gray to pinkish red, and the surface is smooth and glistening. It may be single, but is usually found multiple, and occurs in all sizes from that of a pea to a walnut or larger. When single it is less apt to recur after removal, or recurrence is longer deferred. Exceptionally it may lie far back in the nostril, or even project into the nasopharynx, when it is apt to be more fibrous, and is then known as retronasal fibromucous polypus. Polyps are stated to be rare in childhood; but I have observed them from the age of eight years upward, and a case under one year assumed to be congenital has been reported. Also I have known them to develop at the advanced age of eighty years.

Etiology. The most frequent underlying condition is ethmoiditis, a chronic inflammation of the mucoperiosteum and bone of the ethmoid labyrinth and middle turbinated body. The polypoid thickening and granulation tissue from which polyps develop is the result of simple inflammatory action which varies toward œdema. An analysis of the evidence[2] favors the view that the inflammation begins in the mucosa, and thence is liable to extend to the periosteum and bone, although a few[1] contend that the initial lesion is in the bone. A disintegration of bone, or rarefying osteitis, is often associated. There may be actual caries[2] of bone; but usually the condition is better described as a degeneration, in which state it is easily denuded and its trabeculæ readily broken down. Zuckerkandl's[3] observation on cadavers, that two-thirds of all nasal polypi proceed from the middle meatus beneath the middle turbinated body, is confirmed by accurate clinical examination. (Figs. 443 and 444.) The polyp buds proceeding from the ethmoidal labyrinth grow in the direction of the least resistance downward through the hiatus semilunaris, which is the common outlet, and form attachments to its projecting lower edge and to the bulla ethmoidalis above. The point is, that although distinct polyps are found to be attached to the borders of the hiatus, in a large proportion of cases the initial lesion is a diffuse ethmoiditis.

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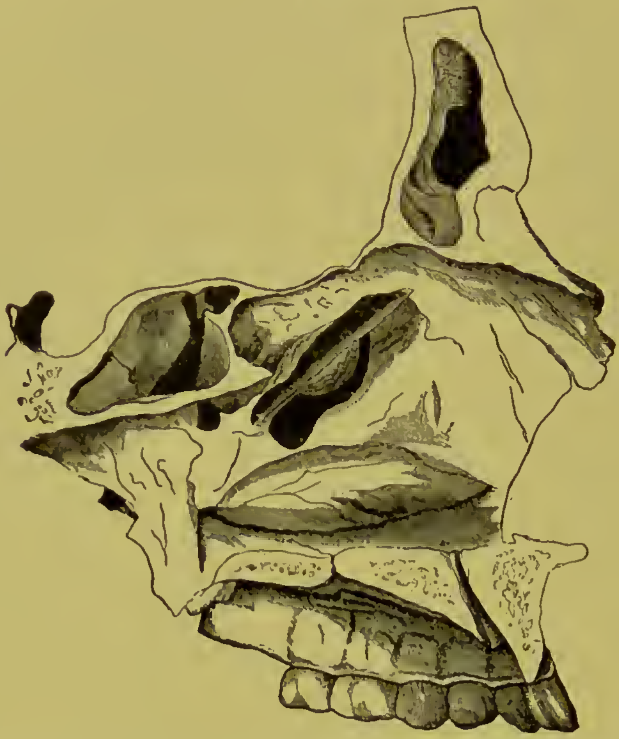
[1] John N. Mackenzie The Journal of Laryngology and Rhinology, February, 1897, p. 57.

[2] Cordes. Archiv f. Laryngologie, 1900, Band ix., Heft 2.

Fig. 443.



Representing the outer bony wall of the left naris, with the middle turbinated body turned upward to show beneath the hiatus semilunaris, to the edges of which polyps are frequently attached. (Author's specimen.)

Next in frequency polyps originate from the free border of the middle concha, then from the superior meatus, superior concha, and accessory sinuses. In typical form they are very rare on the inferior concha and septum, although sessile polypoid tissue is common on the former and at the rear of the septum, while other tumors, notably, angioma, papilloma, and sarcoma, occur at the anterior part of the septum, and are sometimes loosely spoken of as polyps. The neurosis which is fundamental to asthma and hay fever may be regarded as one of the predisposing causes of ethmoiditis, for it is a frequent concomitant in this class of cases. The various causes of acute and chronic rhinitis to which reference may be made are also operative. Obstructive deformities of the septum may encourage the formation of nasal polypi, in which case they are often found also in the larger nostril, and when in the narrow nostril behind the obstruction. (Fig. 445.) A purulent outflow through the hiatus semilunaris from empyema of the antrum of Highmore is an exciting cause of ethmoiditis and polypus, and the same may be said of primary suppuration of the frontal and sphenoidal sinuses and ethmoid cells. Especially in maxillary sinusitis of dental origin the suppuration of the antrum seems to precede the formation of polypi. On the other hand, suppuration of these cavities seems more often to result from a

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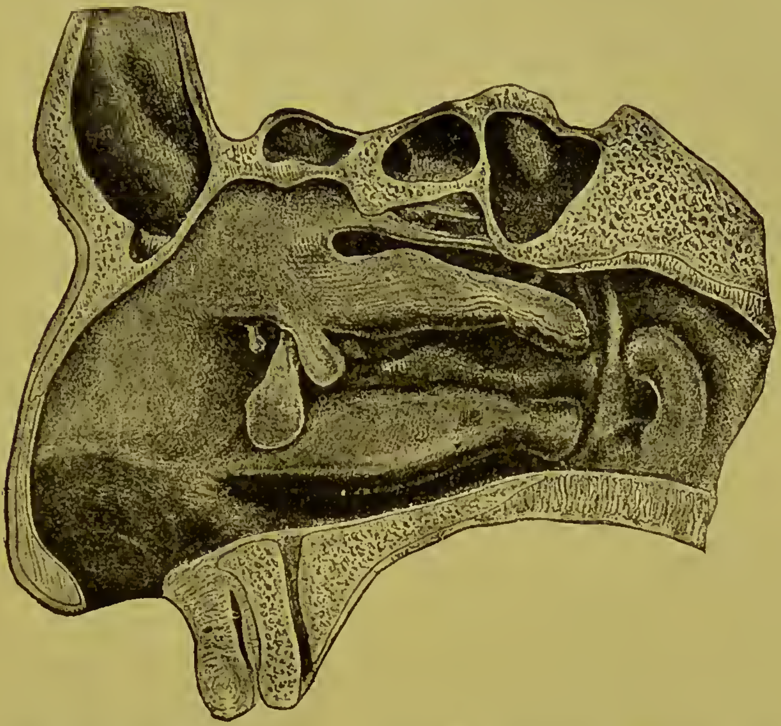
[1] Lambert Lack. The Journal of Laryngology, Rhinology, and Otology, February, 1901, p. 64.

[2] Edmond Woakes. Nasal Polypus, etc., in Relation to Ethmoiditis.

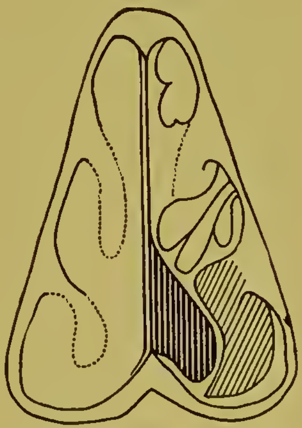
[3] Zuckerkandl. Anatomie der Nasenhohle, S. 64 et seq.

FIG. 444.



Outer wall of the right nasal cavity, exhibiting three polypi. (ZUCKERKANDL.)

FIG. 445.



Nasal polypus in conjunction with obstructive deformity of the septum. (Author's case.)

closure of their orifices by polyps which were primarily the outgrowth simply of an initial non-suppurative ethmoiditis. I have frequently observed simple ethmoiditis with polypus and, perhaps, asthmatic symptoms, but without any sinus suppuration, and years later encountered the same cases then affected by suppuration in one or more sinuses, or, with bilateral polypi there may be sinus suppuration on one side and not on the other.

Pathology. The pathogenesis of nasal polypus has been outlined in considering the etiology. It is further elaborated in the section on pathological histology.

Microscopic Appearance.[1] The epithelium is ciliated columnar, thickened in areas. The stroma is a network of areolar tissue, the size of whose meshes is determined by the amount of serous infiltration. The meshes contain under high power granular coagulated fibrin, cobweb-like threads of fibre bundles, and small round cells, which are more numerous in the immediate vicinity of the blood-vessels from which they exude. From the round cells young connective tissue is formed with its branching cells. The serum contains salts in solution and mucin

Polypoid Cysts. Occasionally a growth which has the external appearance of an œdematous nasal polypus is found to be a cyst, the fluid contents usually escaping as the wire is tightened around its pedicle. It may be small or large, single or multiple, and exist alone or in association with ordinary polyps growing from the same situation. In one case the cyst that grew from the posterior part of the middle meatus twice recurred, each time as a cyst. Again, polyps may be partly cystic, the spaces containing at times a yellowish purulent fluid. Both are regarded as glandular retention cysts. They differ from cysts of the middle turbinated bone and from dentary cysts.

Symptoms. Nasal obstructions, excess of secretion, intranasal pressure, and headache, defective speech, aural complications, impairment of smell and taste, and nasal reflexes—*e. g.*, asthma, migraine, cough, sneezing, etc.—are the salient manifestations. The tumors are prone to swell in damp weather, thus increasing the nasal obstruction. Mouth-breathing will result in irritation of the pharynx and larynx. The secretion may be simply mucous, possibly excoriating, or in case of conjoined sinus suppuration it will be purulent and may then be fetid. The speech is "dead" from absence of nasal resonance.

Impairment of the sense of smell may be the first symptom, as in one patient, a physician, who complained only that he had lost his customarily keen olfactory sense, and in whom polypi buds could barely be seen jutting out from beneath the middle turbinated bodies. In fact, the disease presents so many important phases in connection with its associated underlying and resulting conditions that a clinical classification, with brief case-descriptions and illustrations, will best portray it.

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[1] Jonathan Wright. Transactions of the American Laryngological Association, 1893, p. 69.

Nasal Polypus with Simple Ethmoiditis. Mr. B., aged forty years, complains of pressure far back between the eyes. The base of the nose externally is broadened, and there is infra-orbital swelling which simulates the physiognomy of Bright's disease. There is great enlargement of the middle turbinated bodies, which press firmly against the septum on each side. They have a glistening aspect and are œdematous, pultaceous to the touch. (Fig. 446.) A compact bunch of small polyps jut out from beneath each middle concha.

Mr. N. M., aged fifty years, had a few polyps removed ten years ago. Nasal respiration has since been free, but of late years he has suffered a sense of pressure far back between the eyes, at times so severe as to induce a high degree of nervous excitement. Enormous osseous overgrowth, with polypoid degeneration of the middle turbinated bodies, which together with a small polypus literally pack the upper channels of the nose. Resection of the middle turbinated bodies was made which laid bare the hiatus, bulla ethmoidalis, and in part the other ethmoid cells, from which polyps could then be seen to protrude, and whose walls were in a similar state of polypoid degeneration. On the left side, curiously, no true polyps had been visible until after removal of the middle turbinated body, when two, of good size, but of flat shape, were exposed, which projected from the region of the ethmoid cells. (Fig. 447.) The term "intracellular polyps"[1] has been given to this type, in which growths proceeding from the ethmoid cells are contained in the middle meatus beneath an enlarged and perhaps excavated middle concha. In a study embracing a series of forty cases of nasal polypus, fourteen were of the class represented by these two. In most of them there was

FIG. 446.

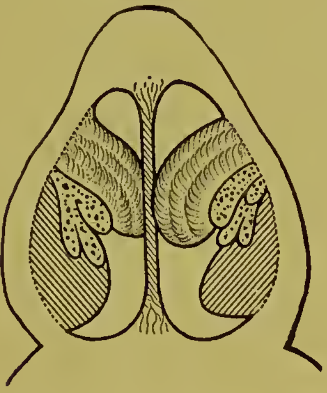

FIG. 447.

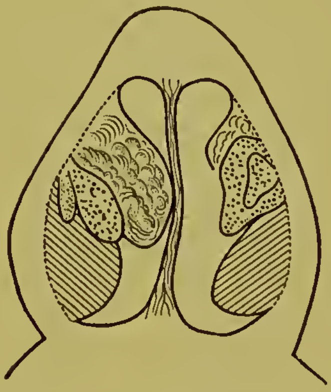

FIG. 446.—Ethmoiditis with nasal polypi and polypoid degeneration of the middle turbinated bodies. (Author's case.)

FIG. 447.—Representing on one side polyps growing from the ethmoid region, visible only after resection of the middle turbinated body. (Author's case.)

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[1] Bosworth. Transactions of the American Laryngological Association.

polypoid transformation of the middle turbinated body, and two of them had each a large typical polyp developed from this process of the ethmoid, aside from the other polyps which proceeded from the middle meatus.

Nasal Polypus with Vasomotor Ethmoiditis. This class is introduced in recognition of a complex of symptoms which includes, with variations, asthma, hay fever, hyperæsthetic rhinitis, intumescent rhinitis, and polypus. These, when occurring in the same patient, indicate a fundamental neurotic habit. That the neurosis involves an impairment of the vasomotor nerve control over the affected areas is purely conjectural; but it is a reasonable hypothesis, and one which is intended to keep in mind the associations and partial dependence of asthma upon ethmoiditis and polypus.

Miss McC. has suffered from complete nasal obstruction for several years, together with asthma and hay fever. There were multiple polypi which, after removal, would rapidly redevelop, growing in profusion not only from the middle meatus, but also from the superior meatus posteriorly, and from both the middle and superior turbinated bodies. The entire nasal mucosa was in a state of œdematous tumefaction, as if devoid of vasomotor control. The hiatus and ethmoid cells just above, when exposed by resection of the middle concha, were found covered with polyp buds and granulation tissue which were curetted and picked off by cutting forceps. Intermittent intumescence of the nasal tissues continues; she is comparatively but not absolutely free from asthma, and the hay fever is mitigated.

Out of a series of forty cases, this case is representative of a group of nine. Asthma was a universal symptom; four of the nine had hay fever, and the others were especially susceptible to dust, coal smoke, fog, aroma from horses, etc., which sufficed at any season to excite tumefaction.

Nasal Polypus with Suppurative Sinusitis. This class is represented in the series of forty by a group of twelve. Nearly all had empyema of one or both maxillary sinuses. Two had in addition empyema of the frontal sinuses, and one of these conjoined suppuration of the ethmoid cells. Two others had suppurative ethmoiditis without involvement of the other sinuses. Curiously enough, only two of these suppurative cases suffered from asthma, and they, while having polyps on both sides, had suppurative maxillary sinusitis on only one side, and in both of them the ethmoiditis polyps and asthma seemed to precede the suppuration.

Mr. McC., aged fifty years, has suffered from nasal polypi for ten years. One year ago intense pain commenced over the left frontal sinus, then supra-orbital bulging and tumefaction, and finally, after months of intense suffering, spontaneous discharge of pus occurred from the frontal sinus. The left middle turbinated bone was enormously enlarged and in an advanced state of polypoid degeneration, the whole mass, together with some small polyps, being packed in place so firmly as to obliterate the middle meatus and to press the septum toward the opposite side. The removal of this mass exposed polypoid excrescences and suppuration of the ethmoid cells, which were then scraped and drained. He had also empyema of the maxillary antrum.

Miss P., aged twenty years. The right middle turbinated body is enlarged and pressed against the septum. The bulla ethmoidalis is also enlarged, the two together presenting the deceptive appearance of a double turbinated body or one that has undergone apparent cleavage. (Fig. 448.) From the fissure protrude several small polyps and a purulent secretion, which in the absence of maxillary and frontal sinusitis must proceed from the ethmoid cells. A fine probe inserted into the fissure detects denuded bone. Resection of the middle turbinated body and curetting of the bulla and vicinity resulted in a cure.

Diagnosis. It is usually only necessary to look with a good light and feel with a probe in order to establish correspondence with the physical characters described, but more rarely an accurate knowledge of all pathological states is essential to a precise diagnosis. Polypus is to be distinguished from mere hypertrophic rhinitis, and septal excrescence by the fact that the turbinated bodies, although swollen, and the septum, although deformed, occupy their natural positions, while a polypus occupies one of the spaces beneath, between or beside these structures. (Fig. 449.) It is, moreover, movable, and generally of a paler color. Sarcoma should be carefully excluded by microscopic examination in any case in which the clinical aspects approach malignancy.

FIG. 448.

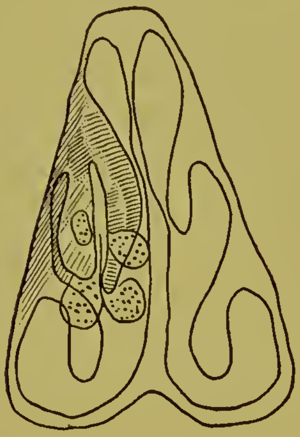
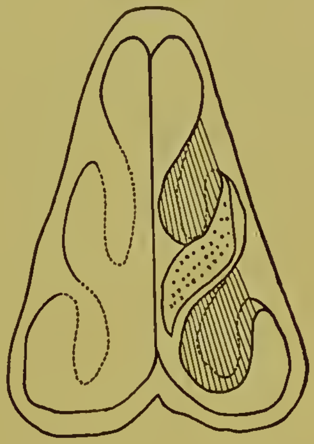


FIG. 449.



I have observed polypus and sarcoma side by side in the same nostril, and I am inclined to share the widespread belief that ordinary polypus may in certain subjects become the site of sarcoma, although it is difficult of absolute demonstration.

So-called "bleeding tumors of the septum," if not simple vascular hypertrophy or syphilitic gummata, are usually angiomata, telangiectomata, or sarcomata.

Prognosis. This is excellent if the disease be effectively treated; otherwise recurrence is usual.

Treatment. The best means for the removal of typical polypi is the cold wire snare, supplemented by sharp cutting forceps, and occasionally a sharp curette. The technique is described in another chapter. Local medicinal measures, such as the injection into the polyps of perchloride of iron solution, chromic or trichloracetic acids, are inferior modes of treatment. Weakened alcohol, etc., to discourage their growth, is of questionable utility. Apart from the removal of the polyps an important part of the treatment consists in the establishment of free nasal passages for respiration, drainage, vision, and instrumental manipulation, for otherwise the polyps can be but imperfectly removed, and are certain to recur. To this end hypertrophied turbinated bodies and septal spurs should be reduced and serious deflections of the septum straightened. Furthermore, in 1891, in a paper before the American Laryngological Association,[1] I proposed as part of the radical treatment of nasal polypus, the resection of the anterior part of the middle turbinated bone in order to facilitate access to the points of development, high up in the middle meatus. The method has also been advocated by Grünwald,[2] Hajek,[3] and others. Associated sinus suppuration should receive appropriate treatment.

Intranasal and Retronasal Fibromucous Polypus. This neoplasm, also called myxofibroma, contains a variable, often a large proportion of fibrous tissue which gives it a firmer consistency, denser structure, and somewhat darker color than the ordinary mucous polypus. It is more vascular, and the intranasal growth remains sessile longer. It is prone to originate toward the rear of the nasal fossa, the median and posterior aspects of the middle turbinated body or adjoining parts of the ethmoid and sphenoid bones being seats of attachment. Thence it may project forward or backward. It is attached farther forward than a regular nasopharyngeal fibroma. In diagnosis one should be careful to exclude sarcoma. The symptoms and treatment of the intranasal growth are the same as for ordinary nasal polypus. The symptoms and treatment of retronasal fibromucous polypus cannot be better described than in relating the following case:

Mr. M., aged about forty years; increasing nasal obstruction for years. The growth acts like a valve, permitting a slight ingress of air, but closing the choanæ upon expiration, an action which is particularly noticeable and disturbing during sleep. At first, if he would lie upon the right side the tumor would gravitate so as to free the other side; but latterly it has grown too large to afford even this relief. On examination posteriorly the tumor is seen to project from the right nostril into the nasopharynx, which it nearly fills. (Fig. 450.) It is barely visible by anterior inspection, because a deflected septum limits the view. An effort to snare from in front failed. A loop of No. 5 piano wire carried by a curved canula through the mouth and nasopharynx enveloped part of the growth, but bent the canula before cutting through, and had to be detached. A cautery snare similarly adjusted divided part of the tumor, permitting the remnant to slip forward so that it could be snared anteriorly.

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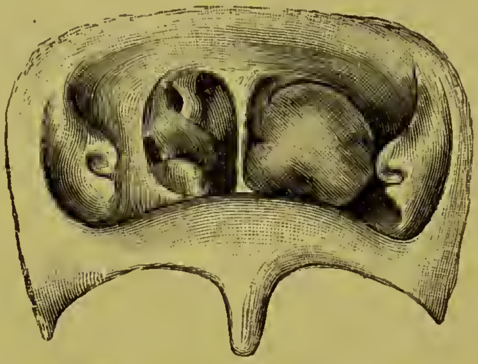
[1] Casselberry. Transactions of the American Laryngological Association, 1891.

[2] Grünwald. Die Lehre von den Naseneiterungen, 1893. München und Leipsig, Verlag von J. F. Lehmann.

[3] Hajek. Archiv f. Laryngologie und Rhinologie, 1896, Band iv., Heft 3.

FIG. 450.



Retronasal fibromucous polypus. (COHEN.)

Intranasal Fibroma. Under this title it is proper to include only pure or nearly pure fibromata which originate in the nasal fossæ anterior to the nasopharynx. They are rare. Schmidt[1] observed two among 33,000 patients. The author has reported[2] a typical case of strictly nasal fibroma of dense consistency, microscopically examined, which originated from the vault, and which, pressing the septum to the opposite side, had caused absorption of the middle turbinated body, the trabeculæ between the ethmoidal cells, and part of the anterior wall of the sphenoidal sinus, the nostril after its removal presenting a large cavernous aspect with smooth walls. It was removed in fragments by the galvanocautery, and has not recurred during thirteen years. In the nasopharynx pure fibromata are comparatively common, and some of the nasal cases have originated from parts bordering upon the nasopharynx—*e. g.*, the walls of the posterior ethmoidal cells and sphenoidal sinus, the posterior edges of the septum, and the rear ends of the turbinated bodies, since here is found in greater abundance the fibrous stratum from which they are assumed to develop; but no part of the nose is exempt, for well-authenticated cases are recorded in which the origin was from the anterior wall of the sphenoidal sinus,[3] the rear of the vault[4] as demonstrated by an autopsy; the middle[5] and inferior turbinated bodies, the roof of the nasal fossa,[6] the cartilaginous septum,[7] and the nasal floor.

Etiology. One case, involving the septum, was directly attributable to a blow on the nose; in another it followed some years after the removal of a mucous polyp from the same site, and hence is attributable to a perversion of the chronic hypertrophic inflammatory process similar to that which results in mucous polypi. Both sexes and all ages seem equally liable.

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[1] Schmidt. Die Krankheiten der oberen Luftwege, 1894, S. 480.

[2] Casselberry. Nasal Fibromata. Journal of American Medical Association, April 21, 1888.

[3] Casselberry. Journal of American Medical Association, April 21, 1888.

[4] Gerdy. Cited by Mackenzie. Diseases of the Throat and Nose, vol. ii. p. 375, Am. ed.

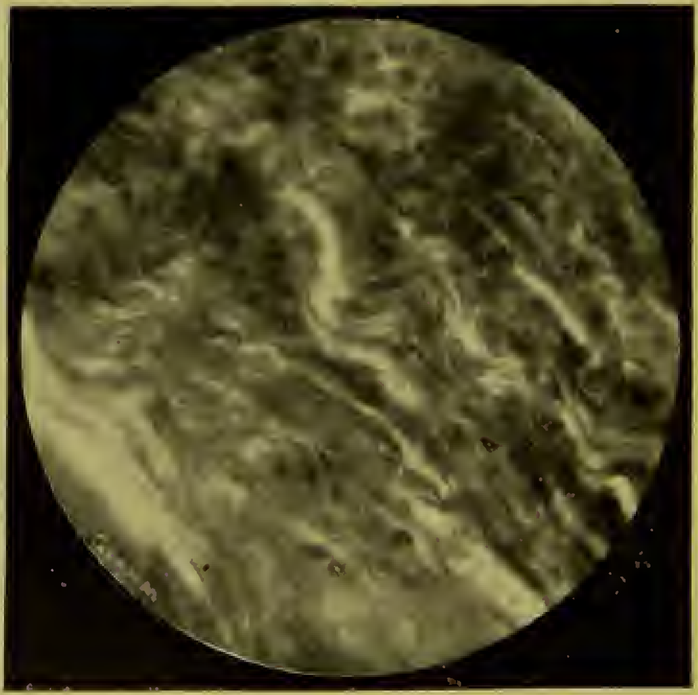
[5] C. H. Knight. Journal of Laryngology, Rhinology, and Otology, March, 1896, p. 156. Newcomb. The Laryngoscope, July, 1901, p. 70.

[6] Mackenzie. Diseases of the Throat and Nose, vol. ii. p. 376, Am. ed.

[7] Buchanan. Glasgow Medical Journal, 1882, p. 211.

Pathology. Fibrous tumors in this situation present the ordinary pathological characters of fibromata in general. In consistency they vary, being sometimes very dense, and at other times softer and more succulent. The fibrous tissue which constitutes the chief part of the growth is grouped in bundles of various sizes, or is simply closely interlaced and devoid of definite arrangement. A few minute cells, either round or spindle-shaped, may be present among the fibres or in large numbers around the bloodvessels. A smooth fibrous capsule usually envelops the whole. The following is Dr. Jonathan Wright's description of sections from the author's specimen: "The sections are largely made up of fibrous connective tissue whose outlines do not show very clearly, owing probably to the long time the specimen has been kept. I presume you are justified in calling the growth a fibroma, although there are a number of œdematous areas in it, as well as the evidences more commonly regarded as those of chronic inflammation." (Fig. 451.)

FIG. 451.



Intranasal fibroma. × 300. (Author's specimen.)

Symptoms. The early symptoms are those of a catarrhal nature, followed by obstruction and distention of the fossa. Its development continues, to the detriment of bones or cartilages that may be in the way. These are absorbed, enveloped, and rent asunder, the neoplasm penetrating into fissures, accessory sinuses, and neighboring cavities. The bridge of the nose is flattened, the eyes bulged forward, and the cheek swollen, the whole constituting the hideous deformity known as "frog-face." Frequent and dangerous attacks of epistaxis may proceed from surface ulcerations. Extension upward may open the cranial cavity.

Diagnosis. A probable diagnosis is not difficult. Its appearance *in situ* differs much from that of the mucous polyp. It is not multiple, but may be lobulated. The base is broad, the color is dark red, there is no translucency, and it is firm and resistant to pressure by a probe. It is more difficult to distinguish it thus from fibrosarcoma. Microscopic examination is the only means of positive diagnosis.

Prognosis. There is a tendency to recurrence after removal, although, if thoroughly extirpated and the base cauterized to the bone, the prognosis should be good. Intranasal fibroma, like fibromucous polypus, appears to form a favorable nidus for the development of sarcoma.

Treatment. If small it could be removed *in toto* by the galvanocautery snare. When large and confined by adhesions it is necessary to resort to the author's expedient of dividing it into two or more tongues or fragments, over which the snare may then be more easily adjusted. Repeated sittings may be necessary, and if profuse hemorrhage be excited an iodoform gauze packing should be inserted. In cutting operations there is great danger from hemorrhage, Gerdy's[1] and Seiler's[2] cases having terminated fatally from this cause. Nevertheless, in long-continued neglected cases, where the neighboring cavities are encroached upon, it may be necessary to make an external operation, such as von Brun's, Ollier's, or Rouge's, or a resection of the superior maxilla.

Intranasal Papilloma. (*a*) **Fibroma Papillare.** (*b*) **Adenoma Papillare.** The true papilloma or papillary fibroma, commonly called a wart, is often found in the vestibule of the nose at or near the junction of the skin and mucous membrane, and is then usually of the hard, squamous variety, as it develops from the cutaneous structure.

Strictly within the nose true papilloma occurs but rarely, but still it does occur. It may also be of the squamous type,[3] as are the warts of the pharynx and larynx, or it may be soft, quite vascular, and composed primarily of columnar epithelium[4] which, however, may degenerate in places into flat cells. Whether the epithelium is of the columnar or squamous type the branching pedicle or central tissue is fibrous and without glands. It may be pedunculated or diffusely sessile. The favorite sites are the cartilaginous septum and the floor of the nose.

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[1] Gerdy. Loc. cit.

[2] Seiler. Transactions of the Pathological Society of Philadelphia, 1884, p. 126; cited by Bosworth, Diseases of Nose and Throat, vol. i.

[3] Hellman. Archiv f. Laryngologie und Rhinologie, Band vi., Heft 2, S. 171; Douglass, New York Medical Journal, January 7, 1899, p. 6.

[4] Jonathan Wright. Transactions of American Laryngological Association, 1895, p. 177.

Symptoms. The salient symptoms are nasal obstructions and epistaxis, either of which may be absent if the growth be quite small or not vascular.

Diagnosis. The papillomata would be distinguished from malignant neoplasms, especially epithelioma, by microscopic examination coupled with the clinical aspect and course of the disease.

Prognosis. It tends to recur unless thoroughly removed; but complete removal is usually possible in the nose.

Treatment. They may be removed by the cold or hot snare, or, if accessible, by knife or sharp forceps. Hemorrhage, if persistent, may be controlled by an iodoform gauze tampon. Chromic acid is best adapted to the cauterization of the base, which is often indicated to prevent recurrence, although unnecessary irritation by repeated applications of caustics or inefficient operative measures is to be avoided. For inveterate recurrence it is said the local and systemic use of the tincture of thuja occidentalis,[1] applied on cotton for twenty minutes twice daily, and a teaspoonful taken thrice daily is of service.

Adenoma Papillare. In addition to true papilloma or papillary fibroma there are not infrequently found in the nose glandular overgrowths, papillary hypertrophies, and inflammatory thickenings which present to the naked eye a papillary surface, and some confusion has arisen by naming these also papillomata or warty growths. Hopmann's[2] so-called papillomata, which are implanted usually upon hypertrophied turbinated bodies, contain glandular elements sufficient to justify the term "adenoma papillare." Others are mucous polypi[3] with a papillated surface, and still others are to be regarded merely as localized inflammatory overgrowths.

Intranasal Angioma. **Bleeding Polypus of the Septum.** *Synonyms.* Angiofibroma, fibroangioma, fibroma angiomatoides, telangiectoma, cavernous angioma, bleeding polypus of the septum.

This tumor is probably not so rare as has been represented, being described under various names. Several papers[4] have recently appeared in German literature under the title of "bleeding polypus of the septum," and others in America under the titles of telangiectoma[5] and cavernous angioma.[6] The detailed pathological description of all these tallies closely with each other and with the case below described.

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[1] E. F. Ingalls. Transactions of American Laryngological Association, 1890, p. 53.

[2] Hopmann. Archiv. f. path. Anat., Physiol. und Med., 1883, No. 93, p. 213; cited by Jonathan Wright, Transactions of American Laryngological Association, 1891, p. 44.

[3] Noquet. Rev. de laryngologie, etc., July, 1889, and June, 1891; cited by Jonathan Wright, loc. cit.

[4] Victor Lange. Internationales Centralblatt für Laryn. und Rhinol., June, 1893, p. 590; Schadewaldt, Archiv f. Laryngol., Band i. S. 260; Alexander, ibid.; Scheier, ibid.; Heymann, ibid.

[5] Pierce. Transactions of American Medical Association, Section of Laryngology and Otology, June 1, 1897.

[6] Cobb. Transactions of the Pan-American Medical Congress, 1893, vol. ii. p. 1540.

In the early[1] literature several cases are reported under the name angioma, but some of them are confused with other neoplasms, *e. g.*, angiosarcoma, angiofibroma, etc. About thirty cases in all are reported.

The exact site on the septum has varied, but all were toward the anterior part, and several at the base. The size is from that of a pea to a hazelnut; if much larger, one should strongly suspect sarcoma. The surface is nodulated or furrowed, but may be smooth, the color a mottled blue or red, and the pedicle either narrow or broad.

Cavernous angioma is also described as occurring on the anterior and median portions of the inferior turbinated body. In this situation one must avoid confusing mere hyperplasia of the normal cavernous structure with a neoplasm, although the latter does occur, the illustrations[2] and pathological descriptions showing it to conform closely to angioma, as it occurs on the septum.

Etiology. They are more frequent in females than in males, in the proportion of three to one. The lymphatic temperament seems to be a predisposing condition.

Pathology. The vascular tumors which grow upon the septum narium do not conform exactly to either the typical *angioma simplex* or the *angioma cavernosum.* They contain both bloodvessels and blood spaces, thus far representing rather a combination of the two types, and they contain also a larger proportion of reticular connective tissue, with either round or spindle cells. In some this reticulum has a fibrillary character, justifying the term angiofibroma. If composed entirely of dilated pre-existing vessels rather than newly formed vessels, the term telangiectasis or telangiectoma is by some preferred.

Microscopic Appearance. In the case below mentioned the tumor was composed largely of bloodvessels and blood spaces. The bloodvessels vary in size, and most of them contain more or less blood. Some of the vessels are collapsed. The blood spaces are partly lined with epithelium. Between these vessels and blood spaces is connective tissue in which are numerous round cells and young connective-tissue cells. On one side of the tumor is a remnant of mucous membrane.

Symptoms. Attacks of bleeding are frequent and severe, especially if the tumor is located near the orifice. The degree of obstruction depends upon the size of the tumor.

The condition is exemplified in the following case:

Mrs. T., aged about thirty years, married, pregnant. Has been annoyed for the past few months by frequent bleeding from the right nostril, and gradually increasing obstruction. Examination disclosed a soft, reddish, irregularly nodulated tumor, the size of a small bean, attached by a rather broad pedicle to a small excrescence of the septum at the point of junction of the cartilaginous segment with the septal process of the superior maxilla, therefore just within the nostril and close to the floor. It bled easily on contact with a probe. I removed it with a cautery snare, and cauterized the base with chromic acid. Three weeks later one small vascular point, still unhealed and disposed to bleed, was again cauterized with chromic acid. No recurrence during three years.

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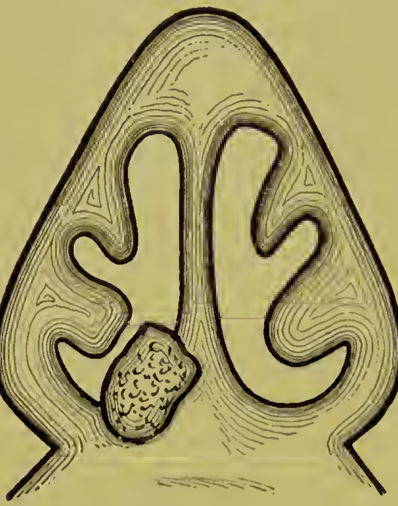
[1] Bosworth. Diseases of the Nose and Throat, vol. ii. p. 431; Schwager, Archiv f. Laryngol. und Rhinol., Band i. S. 105.

[2] Jurasz; cited by Schwager, loc. cit.

Fig. 452.



Intranasal angioma. (Author's case.)

Diagnosis. The tumor may pulsate if connected with an artery, and the color is then more red; but if chiefly venous the color is bluish. Sarcoma should be excluded by careful microscopic examination.

Prognosis. If well removed it shows little tendency to recur.

Treatment. The growth may be removed by the cautery snare, very slowly by a cold wire snare, by silk ligatures, or by electrolysis. The base should be cauterized, preferably by chromic acid.

Intranasal Adenoma. A pure adenoma is a benign hyperplasia of gland structure, having its type in the acinous or tubular glands. Obstruction of the ducts may lead to cystic formation. More often it contains considerable fibrous connective tissue, when it becomes in reality an adenofibroma. Such a neoplasm occasionally originates from the glandular structures in the posterior surface of the velum.

In the nose pure adenoma seems to occur but very rarely. Certain mucous polyps may contain adenomatous elements. Adenoma papillare receives reference under intranasal papilloma. It is usually implanted upon hypertrophied turbinated tissue, contains glandular elements, and has a papillated surface.

Adenosarcoma is encountered in the nose, and is included in the chapter on sarcoma. Rarely, the sarcomatous element has been so slight as to induce the reporter to class it as adenoma, in accordance with the preponderating tissue, for, while semimalignant, it is less so than the average sarcoma. In Harris'[1] case, after six years' suffering from asthma and nasal polypi many times removed, he experienced an inveterate rapid recurrence of the polypi, which finally became soft, necrotic, and friable, packed the maxillary and ethmoid sinuses, and terminated fatally eight years after the commencement of the asthma and polyps.

The structure of this growth as described by Jonathan Wright[2] may serve to exemplify the class: Composed principally of glandular columnar epithelium regularly formed into acini and ducts, in some parts involution of the epithelium was surrounded by a framework of new connective tissue, which in a few places is made up of spindle cells, and in considerable areas is densely crowded with round cells, some of both the round and spindle cells being so arranged as to suggest sarcomatous tissue.

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[1] Harris. Lancet, January, 1896. Reprint.

[2] Wright. Quoted by Harris, loc. cit.

Adenocarcinoma receives reference under carcinomata.

Symptoms. These would depend upon the exact character, situation, and size of the growth; but the symptoms likely first to attract attention would be those incidental to nasal obstruction.

Diagnosis. Adenoma is prone to develop in middle and advanced life, fibroma in the second or third decade. A careful microscopic examination, considered in connection with the clinical aspects, may be necessary to exclude sarcoma.

Prognosis. This is favorable when there is an entire absence of malignant elements.

Treatment. When strictly benign there is little difficulty in its eradication by the means employed for other nasal neoplasms. If there is a malignant tendency the treatment would be in accordance with the principles enumerated in the section on sarcoma.

Intranasal Osteoma; Chondroma and Odontoma. **Osteoma.** *Synonyms:* Exostosis, enostosis. The term exostosis has also been applied to excrescence of the septum, but is not now generally so used.

A form of exostosis which constitutes an osseous tumor somewhat rarely develops from the walls of the ethmoidal cells, frontal or maxillary sinus, and, while occupying to some degree the nasal fossa, it usually encroaches upon surrounding parts, especially the orbit. When it develops in the diploë the cortical substance expands and envelops the osteoma, and Virchow[1] draws a distinction between these which he names enostoses and exostoses proper, which originate from the periosteum. Bornhaupt,[2] in reporting a case of frontal sinus osteoma, gathered from the literature 59 cases, 23 of the frontal sinus, 12 of the ethmoidal cells, 10 of the antrum of Highmore, and 5 of the sphenoidal sinus; 87 per cent. of the whole number occurred before the thirtieth year.

Osteomata are described as living and dead, the latter when they have undergone spontaneous loosening from their point of attachment. In Stein's[3] case the osteoma was symmetrical and double, causing the appearance of "frog-face" and complete nasal obstruction.

In Fenger's[4] case the large osteoma, partly living and partly dead, sprang from the ethmoid bone, filled the nasal chamber, and encroached upon the orbit. It followed a fracture of the nose, traumatism being regarded as a common exciting cause. Nasal polypi coexisted, doubtless excited by the irritation and suppuration incidental to the presence of the osteoma.

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[1] Virchow. Cited by Fenger, Journal of American Medical Association, 1888, p. 185.

[2] Bornhaupt. Langenbeck's Archiv f. klinische Chirurgie, 1881, Band xxvi. p. 589; cited by Fenger, loc. cit.

[3] O. J. Stein. Laryngoscope, July, 1900, p. 29.

[4] Fenger. Journal of American Medical Association, 1888, p. 185.

Chondroma. Intranasal chondroma is rare if the term, together with its synonyms—enchondroma and echondroma—be properly restricted to a real neoplasm of cartilage, and not loosely applied to inflammatory spurs and deflections of the septum. A true chondroma usually develops during adolescence, springing from the septal or alar cartilages, or at the inferior junction of the two. It varies in size from that of a hazelnut to an orange, and is round or nodulated, closely resembling a dense fibroma. It is composed of hyaline cartilage with perhaps fibrous tissue near the surface.[1]

The diagnosis would best be confirmed by microscopic examination, for which purpose a segment could be removed by means of a rotary knife trephine. One would wish to exclude chondrosarcoma. From osteoma it is distinguished by its penetrability by a needle.

Chondroma, if not too large, can be removed by a cold snare; the hemorrhage is slight, and it shows no tendency to recurrence. Hence the importance of an early recognition, for when quite large an external operation becomes necessary.[2]

Odontoma. Odontoma is a neoplasm which arises from the germs of teeth, and which is composed of dental tissues, cementum, dentine, and enamel, one or all in varying proportion. The tumor may contain a number, even as many as fifty denticles or tooth-like bodies composed of either cementum or dentine, as the case may be, or even ill-shaped teeth composed of all three elements.[3] The number of such denticles in the human may reach fifty or more. Odontoma involves the nose only by extension from the alveolar process. It encroaches first upon the antrum, filling and distending that cavity, thence possibly projecting into the lumen of the nose.[4] It arises only in youth, before dentition, a point of value in distinguishing it from osteoma. It shows no tendency to recurrence if well enucleated, for which purpose a subperiosteal partial resection of the maxilla through the mouth may be required.

Lipoma. While lipomata are not uncommon on the external surface of the nose, they are not encountered within the nares.

Malignant Neoplasms of the Nose.

Intranasal Carcinoma. Carcinoma occurs less frequently in the nose than sarcoma, but many well-authenticated cases are recorded. It is rarer in the nasal cavities than in other parts of the upper respiratory tract, the larynx, for instance; hence the more detailed description of the disease will be found under carcinoma of the larynx. Squamous-celled carcinoma (epithelioma), cylindrical-celled carcinoma, and glandular carcinoma, soft (encephaloid) and hard (scirrhus), appear in point of frequency in the order named. Favorite sites are the vestibule, cartilaginous septum, middle[1] and inferior[2] turbinated bodies, ethmoid[3] region, and posterior edge of the vomer.[4] It originates more often in the antrum of Highmore, and extends thence to the nose. It develops usually after forty years of age. Billroth has described a "glandular carcinoma" or "cylindrical epithelioma" of less disposition to recurrence, instances of which occur in the nose. The same is known also as adenocarcinoma[5] or malignant adenoma, and consists of a stroma of young connective-tissue cells, lying in which is an aggregation of tubuli lined with a cylindrical non-ciliated epithelium.

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[1] Mackenzie. Diseases of the Throat and Nose, Am. ed., vol. ii. p. 380.

[2] Verneuil; cited by Bosworth, Diseases of the Nose and Throat, vol. ii. p. 435.

[3] J. Bland Sutton. Tumors, Innocent and Malignant, 1893, p. 36; cited by A. W. de Roaldes, loc. cit.

[4] A. W. de Roaldes. Transactions of American Laryngological Association, 1894, p. 91.

Symptoms. In addition to nasal obstruction and distention pain of a lancinating character is a prominent symptom. Invasion of the orbit will cause exophthalmos and blindness.

The **diagnosis**, especially from sarcoma, will depend upon microscopic examination. It does not always involve the neighboring lymphatic glands. The prognosis is exceedingly unfavorable, except in "glandular carcinoma." The principles of treatment are the same as for sarcoma.

Intranasal Sarcoma. Nasal sarcoma is rather frequent. Nine cases have passed under the author's observation, most of which have terminated fatally. Each had long persisted in the hope that he suffered merely from a polypus. A better comprehension of the disease in its early stages is to be desired. The cartilaginous septum is a favorite site for sarcoma. Of 41 cases tabulated by Bosworth in 9 it originated on the septum. This fact is the more important since in this situation, if recognized early, it is accessible for thorough extirpation, even by intranasal methods. This was exemplified in one of the author's cases, a man aged fifty years, whose right nostril was distended by a rather firm neoplasm which projected slightly from the naris and sent tongue-like prolongations backward into the crevices of the nasal fossa, but which on removal was found to be attached only to the upper part of the cartilaginous septum by a pedicle 2 cm. in diameter. Its projecting lobule was abraded and bled freely on slight contact; but its larger part was covered by a thin, smooth, capsular membrane. After complete removal I cauterized the base with such thoroughness as to produce a large perforation of the septum, and, although metastasis in the ethmoid region occurred, it did not redevelop at the original site. The microscopic findings are given under pathology.

Other points of origin are the ethmoid region, the turbinated bodies, and the nasal floor. The antrum is prone to involvement, for it is an available space into which the tumor expands under the pressure of its growth. Less often the neoplasm originates in the antrum and expands into the nose. In advanced cases it may be difficult to determine which course has been pursued; but the antrum and the other accessory sinuses should be kept in mind in connection with possible remedial measures.

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[1] Robert Krieg. Atlas der Nasenkrankheiten, 1901, Plate XXXVI.

[2] Krieg. Loc. cit.

[3] Krieg. Loc. cit.

[4] Schmidt. Die Krankheiten der Oberen Luftwege.

[5] Thorner. Medical Record, September 10, 1898, p. 367.

Cases reported include all ages from four[1] to seventy-eight years,[2] although, in comparison with carcinoma, early ages predominate. My youngest case was a boy of ten years, whose right nostril was packed with a fungoid mass of a few months' development, which proved to be round-celled sarcoma. External operation was declined, and the patient, without treatment, had still survived, but was fast failing, a year afterward.

The oldest of my series was a man, aged sixty-five years, who had an immense growth of three-years' development, with pronounced exophthalmos and swelling of the whole side of the face. It protruded from the anterior naris, projected somewhat into the nasopharynx, and involved the antrum.

Etiology. The still unsubstantiated microbic, that is, the protozoan infection theory of carcinoma, is applicable also to sarcoma, the organisms supposedly exciting a proliferation of connective-tissue cells. Also the Cohnheim theory of an excess of embryonic cells in previously quiescent cyclets may be mentioned. Schmidt ascribes sarcoma to a perverted or atypical syphilitic influence. Trauma is reputed to be a predisposing condition to sarcoma. Without implying a change of type of tissues, it is clinically observed that benign growths occasionally become the site, that is, furnish a suitable nidus for the development of malignant tumors, and the same is true of inflammatory tissue. Thus is explained the rare development of sarcoma in connection with œdematous nasal polypi which, for want of a better name, is termed "myxosarcoma." This type usually grows from the ethmoid region, since that is a favorite site for œdematous polyps. It is exemplified by 2 cases in my series, one a man aged fifty years, who had been subject to nasal polypi which had been periodically removed during several years. Gradually they assumed a cauliflower aspect and a mottled hemorrhagic hue. Bleeding became continuous and at times profuse. He persistently deferred external surgical measures and passed finally from observation, being then in an advanced state of exhaustion.

Pathology. Both the round and spindle-celled types are encountered, and either may be of the small or large-celled variety, the small round-celled nasal sarcoma being especially malignant. Giant-celled or myeloid sarcoma also occurs in the nose, one of the writer's cases being of this form. When truly pigmented it is known as melanosarcoma,[1] also a very malignant type; but nasal cases described as melanotic are not always really such, the discoloration being due to blood extravasation. Another combination is fibrosarcoma, which is encountered in all degrees of malignancy, from the fibroma with which there are mixed only a few round cells, and which may not be malignant,[2] to the sarcoma which has simply a larger amount than usual of fibrous connective tissue mingled with it. Angiosarcoma[3] is encountered especially upon the cartilaginous septum, where it constitutes one of the forms of "bleeding polypus of the septum."

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[1] Bliss. Transactions of American Laryngological Association, 1896, p. 46.

[2] Butlin; cited by Bosworth, loc. cit.

Microscopic Appearance. In the author's case 1, above mentioned, small round cells predominated. In case 2, "myxosarcoma," the section showed, in addition, areas of œdematous polypoid tissue. In case 3 the section showed large numbers of small multinucleated round cells bound together by fibrous connective tissue, also an abundance of mucous tissue.

Symptoms. Nasal obstruction and distention, leading to headache and other pressure manifestations, such as exophthalmos, "frog-face," and local paralyses, are symptoms which vary in degree according to the extent of the growth. To these is commonly added repeated, easily excited, and sometimes severe bleeding attacks and discharge which may be fetid or excoriating. The cervical lymphatic glands are not usually involved until late, and cachexia also may be absent until exhaustion is manifest.

The growth is originally encapsulated and pedunculated, although the parts which present anteriorly are often so broken down and excoriated as to assume a granulated cauliflower aspect, and with closely packed large growths it may not be possible to distinguish the pedicle until after removal. More than one point of attachment may be acquired, or the growth may become a diffused fungoid mass. The surface, if unbroken, is a mottled bluish-gray or yellowish, and the consistency soft, although in two of my cases it was so firm as to suggest fibroma.

Diagnosis. The presence of the symptoms described would be strongly suggestive of sarcoma, although confirmation should invariably be sought by microscopic examination of a fragment removed for the purpose. Even then, for diagnostic purposes, a degree of harmony between the microscopic findings and the clinical aspects should be established, for microscopic errors do occur, and in the nose the normal lymphoid structure, inflammatory and syphilitic infiltrations, and adenoma, may all simulate sarcoma. Carcinoma, although more rare, is also encountered.

Prognosis. If early recognized and thoroughly extirpated, the prognosis is fairly good; but if long established or incompletely removed it is very bad, for diffusion of the cells to a distance in surrounding tissues and metastasis occur. An analysis of sixty tabulated cases would seem to indicate that about half[1] the patients operated on recovered, yet if one excludes cases in which no report is given after six months or a year, the number of recoveries will be reduced to about 25 per cent. Round-celled sarcoma and true melanosarcoma are especially malignant, being liable to very rapid growth and diffusion, yet one certain recovery from the former type and one from the latter are reported. Myxosarcoma is much less malignant and furnishes a number of recoveries. The duration of life in unoperated cases and in those which recur is from two to six years.

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[1] Michael. Annales des Maladies de l'Oreille, du Larynx, etc., 1890, p. 688; Lincoln, New York Medical Journal, October 10, 1885.

[2] Schmidt. Die Krankheiten der oberen Luftwege.

[3] Sendziak. Journal of Laryngology, Rhinology, and Otology, March, 1896, p. 104.

Treatment. First must be decided whether it is an operable or an inoperable case, and if operable whether intranasal or external methods should be pursued. To aid in the determination of the first point sarcomata may be divided into four groups.[2] The first is that of pedunculated tumors. The second group, which comprises tumors with a limited base of implantation, is less favorable than the first for surgical intervention; but when situated near the anterior nares their ablation is relatively easy. Diffuse tumors, on the contrary, which form the third group, when they extend either superficially or deeply, perhaps sending processes into the underlying bones, necessitate grave and difficult operations. Only a question of degree separates them from those of the fourth group, which are situated in immediate proximity to vital parts, and so far-reaching as to be quite inoperable. To decide between the third and fourth group may call for judgment. It may be impossible prior to an operation to determine the extent or attachments of the growth, in which case an external operation may be justified in the hope that it may prove to be eradicable.

The decision between intranasal methods and an external operation will depend upon the accessibility of the base of the growth through the natural passages. When circumscribed, and especially when originating from the cartilaginous septum, thorough intranasal means are to be preferred. If pedunculated and upon the external wall, the same may be said; but if diffuse and running up beneath the middle turbinated body into the ethmoid cells or into the antrum or sphenoidal sinus, the only hope of eradication lies in a formidable external operation to give access to the parts. The nature of this will depend upon the site.

Even for circumscribed easily accessible tumors it is sometimes urged that extirpation would be more certain through the simpler external incisions—*e. g.*, the separation of the ala by an incision in the nasogenal furrow with or without temporary resection[3] of the nasal bones—but, by reason of convenience or prejudice against facial disfigurement, intranasal methods are usually given a first trial. The incandescent snare, when it can be caused to envelop the growth with accuracy, is to be preferred, but the cold wire snare can be used and is often more convenient for fragmental removal. I have found Prince's turbinotomy forceps serviceable for the rapid clearing away of large cauliflower-like masses. Hemorrhage is controlled by iodoform-gauze packing. For destruction of the base I have used the galvanocautery, supplemented by chromic acid, and if prevented by bleeding I have deferred this procedure until the next sitting.

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[1] Boylan. Transactions of American Laryngological Association, 1896. Bosworth, loc. cit.

[2] Plicque. Annales des Mal. de l'Oreille, du Larynx, etc., March, 1890.

[3] Mackenzie. Discussion, American Laryngological Association, 1897.

NEOPLASMS OF THE LARYNX.

Benign Neoplasms of the Larynx. With reference to the symptoms, diagnosis, and treatment, the benign neoplasms of the larynx have so much in common that they may be considered collectively under the heading of their chief representative, papilloma, leaving only brief individual descriptions for the rest of the group.

Papilloma. The most frequent and characteristic type of papilloma in the larynx is that which resembles to the naked eye a cutaneous seed-wart. The neoplasm with its hypertrophied papillæ may be plush-like, foliated, resembling a cock's comb, of a cauliflower aspect, or mulberry form. The growth as a whole is of rather firm consistency, although the surface is soft. It is commonly oval or semiglobular, but may be irregular, even angular in contour. In size they vary from 1 to 10 mm. or more in long diameter. The color grades from pale gray to pink, and they may be single or multiple. The smaller growths are usually sessile; but with greater development they are prone to become pediculated. The pedicle may permit considerable mobility, as in a recent case of the author's, in which a papilloma the size of a bean attached to a vocal cord hung below the glottis during quiet respiration, but rose between and above the vocal cords on phonation. The site is nearly always the vocal cord, especially at or near the anterior third. I have observed the warty growth to spread around the free edge of the cord, involving both the upper and lower surfaces, also to spread from the upper surface into the ventricle, and from the anterior commissure down the tracheal wall. (Figs. 453, 454, and 455.) The ventricular band,

FIG. 453.

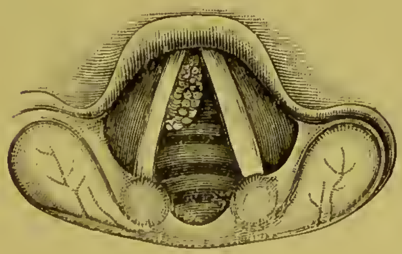
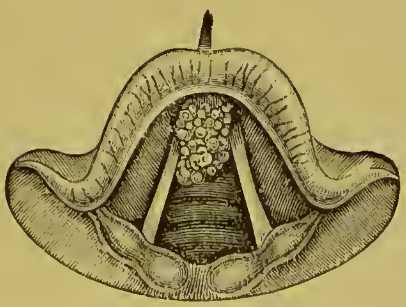


FIG. 454.



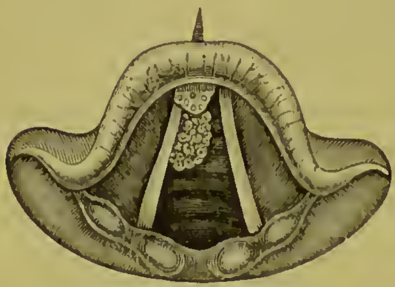
Papilloma of the larynx.

aryepiglottic fold, and epiglottis are rarer sites. The interarytenoid fold is stated to be exempt from true papilloma, but I have notes of two cases in which it was involved together with the vocal cords.

A second form of laryngeal papilloma is characterized by a more diffused distribution, wide areas, any or all parts being covered by the growth which may lead to obliteration of the lumen of the larynx. This diffused type is prone to affect young children; but the author has observed some pronounced instances of it also in adults.

In the case from which Fig. 455 is drawn the larynx at first sight was filled with a mass of papillomata, which on being in part cleared out, were found to spring like a fringe from the entire length of the vocal cords and the interarytenoid fold.

FIG. 455.



Papilloma of the larynx.

A third type of laryngeal papilloma is described[1] as quite small, sessile, and smooth; in fact, indistinguishable from a fibroma, except by microscopic examination.

Etiology. Little is known of the etiology of this and the other benign neoplasms of the larynx. Predisposition is evidenced by papillomata appearing on various surfaces and at times by a family tendency thereto. Males[2] are affected in the proportion to females of three to one. Chronic laryngitis and the congestion which is incidental to overuse of the voice have been apparent causes in a few of the author's cases. Two were singers, one a board of trade operator, one a campaign orator, one a lawyer, etc., yet in most of them the voice was not overtaxed and the larynx not independently inflamed. Four were young children, a much higher percentage than is indicated by Fauvel's[3] 300 cases, of which only 5 occurred in the first decade of life.

Pathology. The essential elements of a papilloma are a connective-tissue stroma, hypertrophied papillæ, and proliferated epithelium. The stroma may be soft and sparse or the compact form may predominate, the latter conditions especially justifying the term papillary fibroma.[4] The hypertrophied papillæ may be very few and simple, each composed at the base of a central core of connective tissue containing a vascular loop and covered by layers of epithelial cells; but usually the papillæ are multiple and branched, each terminal representing one of the small bulbous or pointed protrusions of the surface of the tumor. The epithelium is stratified, but may be thin or very thick, often constituting much of the growth. It both covers and dips between the papillæ. It grows *upon*, but not, as in carcinoma, *into* the underlying tissue. In the depths the epithelial cells are polygonal, but near the surface they assume the pavement form. The term *pachydermia verrucosa* (Virchow) is applied to this type of papilloma in contradistinction to *pachydermia diffusa,* in which there are chronic inflammatory changes in the deeper subepithelial layers.

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[1] Oertel; cited by Jurasz. Heymann's Handbuch, Band i., S. 801.

[2] Jurasz. Heymann's Handbuch.

[3] Fauvel; cited by Bosworth. Diseases of the Throat and Nose.

[4] Ziegler. Lehrbuch der path. Anatomie.

The respiratory tract being derived from the epiblast its papillomata are classed with skin warts of the hard type in contradistinction to soft warts of organs, like the bladder and intestines, which are derived from the hypoblast.

Symptoms. The disability occasioned by any benign tumor of the larynx consists mainly of an interference with the functions of phonation and respiration. The voice first tires easily, then grows steadily hoarse, and finally is reduced to a husky whisper as the growth impinges more and more upon the glottis. Efforts at talking when the larynx is thus disabled are apt to maintain congestion. Dyspnœa occurs when the neoplasm attains sufficient size to occlude the glottis. It is common in young children from laryngeal papillomata, because the larynx is proportionately small. It usually necessitates tracheotomy. Diffuse papillomata may interfere with respiration also in adults. Other benign neoplasms which may grow large enough to obstruct respiration are fibromata, chondromata, lipomata, adenomata, cysts, and thyroid tumors. On the other hand, any of these growths when small and favorably situated may be devoid of symptoms. Cough is rare, but may be severe and lead to suffocative attacks. Laryngeal spasm is observed, especially in childhood, in the form of nocturnal exacerbations of the dyspnœa.

Diagnosis. The differentiation of benign papilloma from carcinoma of the larynx, which may present a papillomatous surface, is dwelt upon in the section on carcinoma. Papilloma occurs at any age, favors the anterior portions of the vocal cords, is not painful, does not bleed, and is distinctly superficial, not impairing the motion of the cord.

Carcinoma favors mature age, often begins on the posterior part of the cord, may ulcerate, bleed, and infiltrate the depths of tissue, impairing mobility. A microscopic examination of a fragment from the depths of the neoplasm should be conclusive; but it is a safe rule to insist upon harmony between the microscopic findings and the clinical aspects.

Singers' nodes differ from ordinary papillomata in being symmetrically bilateral, usually quite minute, and of simple inflammatory origin. They consist of a hyperplasia either of the epithelium or connective tissue, which forms a minute nodule on the free edge of each vocal cord at about the middle or near the junction of the anterior and middle third.

Fibroma is distinguished from papilloma by its smooth surface, circumscribed form, firmer consistency, redder color, and by microscopic examination.

Myxoma, so-called, in the larynx is probably an œdematous or degenerated fibroma, and its exact nature would be determined only by microscopic examination.

Cysts also have a smooth surface, and their liquid contents may be demonstrated by puncture.

Lipoma is rare, occurs usually on the aryepiglottic folds, falling into the pyriform sinus, and not on the vocal cords.

Angioma may have a rough surface not unlike a papilloma; but its vascular or red raspberry aspect will usually indicate its nature.

Chondroma is dense, hard, and immovably attached to one of the cartilages.

Adenoma is very rare, but when it occurs it might readily be mistaken, without microscopic examination, for a large papilloma of the mulberry type.

Prognosis. With respect to the voice, the prognosis is good in the circumscribed type of papilloma, provided the tumor be skilfully and promptly removed. Recurrence is frequent, but is due only to the difficulty of thorough extirpation. Dyspnœa is an evident menace to life, and tracheotomy should not be too long delayed. This is especially true of children who are liable to die, as in two cases of the author's, through nocturnal exacerbation of the dyspnœa, perhaps excited by crying, temper, and fright. The liability of a papilloma or other benign neoplasm to become the site of a malignant growth is also a consideration.

Treatment. The treatment of laryngeal papilloma and of the other benign neoplasms of the larynx is mainly of a surgical nature, and the technique is considered at length in the chapter on intralaryngeal operations. A few principles, however, may be here expressed. Nearly all benign neoplasms of the larynx in the adult are amenable to intralaryngeal methods, which should be skilfully and persistently attempted before resorting to an external operation. Laryngotomy, however, exceptionally may be justified, even in adults, for instance, when the throat is very intolerant, the larynx very deeply placed, and the neoplasm very unfavorably situated—*e. g.*, at or below the anterior commissure, a combination of conditions which has occurred in the author's experience. Thyrotomy has been many times resorted to for papilloma in childhood, but is not in as much favor as it should be, for the reason that recurrence of diffused growths is the rule, while cicatricial stenosis has occurred, and there is an appreciable risk from pneumonia (3.5 per cent.).[1] Delay may be afforded by a low tracheotomy, and in rare instances spontaneous recovery has thereafter ensued, encouraged by enforced rest to the larynx; but indefinite delay becomes far more dangerous than thyrotomy, because of the many accidents which happen to tracheotomy or intubation tubes, and the liability to sudden death before assistance can be rendered. In both children and adults with obstructive neoplasms tracheotomy may be an essential aid not only to respiration, but to subsequent intralaryngeal removal of the growth..

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[1] Manierre. Chicago Medical Recorder, January, 1895, p. 35.

Fibroma. The connective-tissue fibres may be closely interwoven, constituting the hard fibroma, or they may be loosely arranged, with spaces containing serum, when it is known as a soft or œdematous fibroma. Between the two are found all degrees of consistency. Those which approximate the former type are most commonly described under the name of fibroma, while the latter are colloquially spoken of as polyps or incorrectly named myxomata. In the larynx fibroma occurs next in frequency to papilloma, the usual location being one of the true vocal cords, preferably its anterior part, although any feature of the larynx may be the site. The author has recently observed one on the arytenoid eminence, which was large and firm, being distinguished from a cyst by puncture. On the vocal cord it is usually small (2 to 5 mm.), semiglobular or oval, broad based, circumscribed, single, smooth, and of a reddish color; but there or elsewhere it may become quite large, lobulated, exceptionally multiple, pedunculated, and gray white in color. The symptoms, diagnosis, and treatment are considered in common with those of papilloma.

FIG. 456.

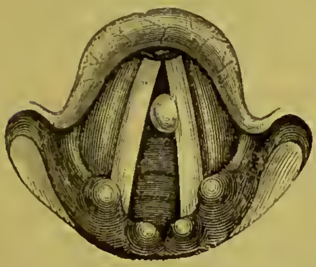

FIG. 457.

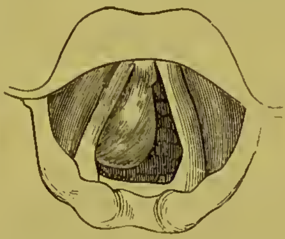

FIG. 458.

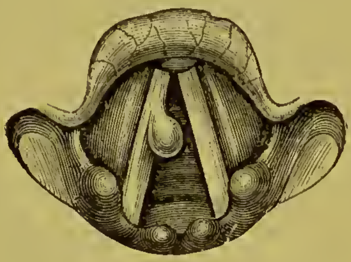

FIG. 456.—Fibroma of left vocal cord. (COHEN.)
FIG. 457.—Fibroma of right vocal cord. (COHEN.)
FIG. 458.—Œdematous fibroma or polyp (myxoma) of right vocal cord. (COHEN.)

Myxoma. Certain growths which spring usually from the edge of the vocal cords and resemble nasal polypi in their lustre, semitranslucency, and soft consistence are variously termed myxomata, polypi, œdematous fibromata, and degenerated fibromata. Like nasal polypi they may be of inflammatory origin, yet they assume the distinctive characteristics of a tumor. Whether they can with propriety be separately classed as myxomata would seem to depend upon whether their gelatinous or mucoserous intercellular substance is the same as the gelatin of Wharton, which is Virchow's prototype for myxomata. The tendency in recent pathology is to regard them as œdematous fibromata. (Fig. 458.)

Cysts. Cysts of the larynx are usually of the mucous retention type. They vary in size from that of a millet seed to a walnut. They are apt to be semitransparent when possessing a clear liquid contents, but may be opaque from thickness of the wall or opacity of the contents. They are round, oval, or spindle-shaped, and are located in the order named on the epiglottis, especially its anterior surface and free edge, vocal cords, ventricles, aryepiglottic folds, and arytenoid region. When projecting from the ventricle they may be mistaken for so-called prolapse of the ventricle. A cyst is not always a mere distention of a previously existing structure; but its wall may acquire a growth of its own and its multiplied endothelium continue to elaborate the contents. Such a cyst is a veritable neoplasm, and may be properly designated cystoma.

Lipoma. Strictly intralaryngeal fatty tumors are exceedingly rare, but a few cases are recorded.[1] [2] They grow more often from the aryepiglottic folds[3] and epiglottis and fall outwardly into the larynx. However, these may attain a size sufficient to obstruct the larynx. They may be single or multiple, smooth, branched, or lobulated.

Angioma. The characteristics of this growth are described in connection with intranasal angioma or bleeding polypus of the septum. It is comparatively rare in the larynx, the author's experience being represented by a single case. In this, as is usual, the growth was located on the vocal cord, overlapping the free edge; it was bright red in color, and its surface was roughened by tortuous bloodvessels. It was raised but little above the surface, and would be classed as angioma simplex. It was destroyed by a single application of the galvanocautery, the patient's singing voice being restored. (Plate XXVIII., Fig. 1.)

Angioma cavernosum appears more like a raspberry, either sessile or pedunculated. Either form may occur at any other site in the larynx than the vocal cord—*e. g.*, the ventricular band.[4] Either form may be multiple, or indeed quite diffused, perhaps involving other parts of the throat and mouth. A laryngeal tumor described under the name of *cavernous papilloma* is doubtless an angioma[5] with a thick epithelial covering. Lymphangioma cavernosum of the larynx is represented in literature by a single case.[6]

Chondroma. Chondroma appears in the larynx as a conical, round, or nodulated hyperplasia, usually of the cricoid cartilage, which forms a sessile tumor, small at first, but of slow, persistent development to the point of occlusion of the larynx. The thyroid cartilage is a rarer site, and still more rarely are the arytenoids and epiglottis the seat. The structure is that of hyaline cartilage, in which will be spots of chalky degeneration and ossification. In diagnosis it may be distinguished from perichondritis by its circumscribed formation, absence of inflammatory conditions, and œdema and absence of the usual causes of perichondritis. The prognosis is good if well removed.

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[1] Bruns; cited by Schroetter, Krankheiten des Kehlkopfes, 1893, S. 209.

[2] Kohler Seifert; cited by Jurasz, Heymann's Handbuch, Band i., S. 810.

[3] Jones; cited by Jurasz, loc. cit.

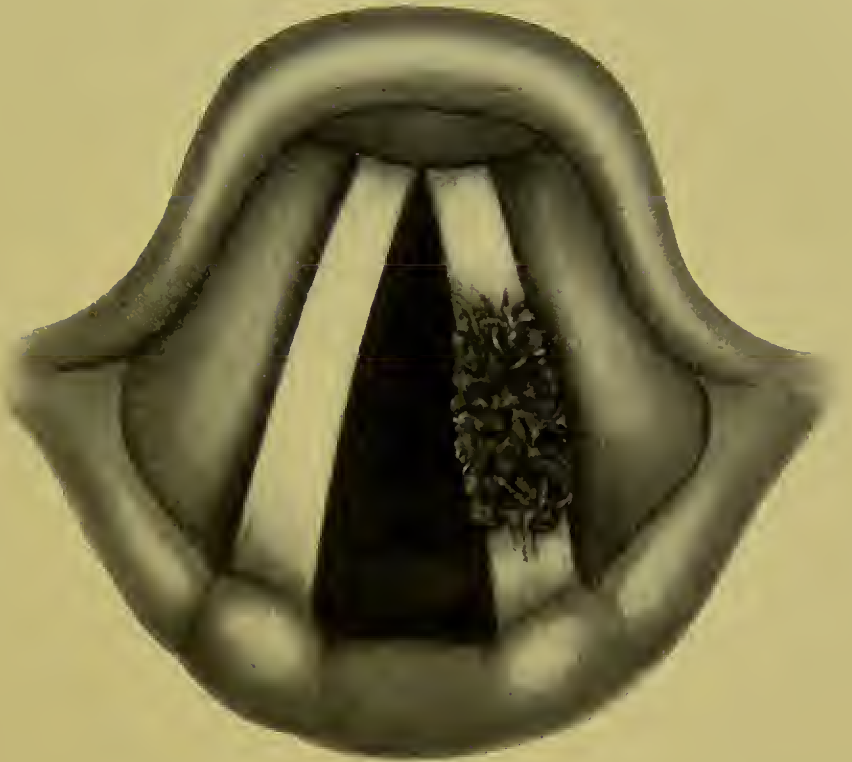
[4] Norris Wolfenden. Journal of Laryngology and Rhinology, 1888, p. 291.

[5] Hooper, F. H. Transactions of American Laryngological Association, 1884, p. 63.

[6] Koschier; cited by Jurasz, Heymann's Handbuch, Band i., S. 811.

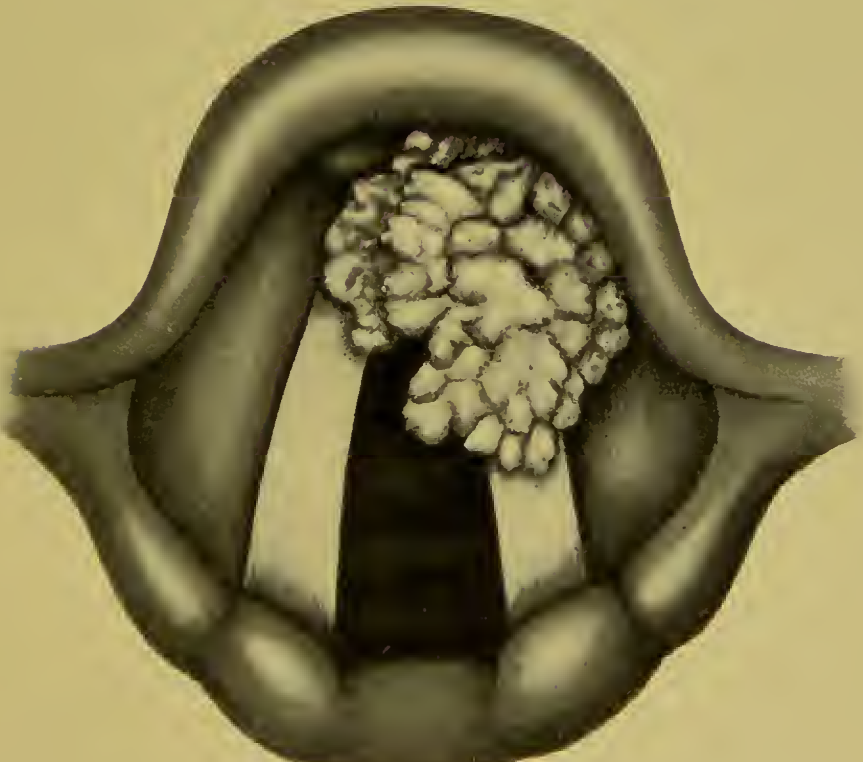
PLATE XXVIII.

FIG. 1.



Angioma of the Left Vocal Cord. (Author's Case.)

FIG. 2.



Recurrence of Sarcoma in the Larynx.

Treatment. When not too large intralaryngeal methods are hopeful. The snare[1] and cauterization by chromic acid[2] have each been successfully used. Galvanocauterization and biting forceps might be utilized. If of great bulk laryngotomy may be necessary.

Adenoma. Benign adenoma of the larynx is represented in literature by but three well-substantiated cases.[3] [4] [5] In each the tumor attained a size sufficient to occlude the larynx, had a granular surface, and color varying from gray to red. The type of nasal neoplasm described as adenoma papillare[6] possibly occurs in the larynx cloaked under the name of papilloma and carcinoma.

Thyroid Tumors of the Larynx and Trachea. The ten recorded instances of thyroid tissue in the larynx[7] have been subglottic, the tumefaction extending from just below the vocal cords to the second, third, or fourth tracheal ring. In two it occupied the posterior tracheal wall. The thyroid tissue enters the larynx not by aberration of the embryonic elements, producing an accessory thyroid gland, such as is found at the base of the tongue, but, as demonstrated in one case by post-mortem dissection,[8] the thyroid tissue grew into and between the tracheal rings, forming thus a connection between the intralaryngeal tumor and the thyroid gland. The author has observed one case, reported by Freer,[9] in which there was pronounced subglottic infiltration surrounding the interior of the cricoid cartilage, and a large tumor on the posterior tracheal wall at about the third ring. Microscopically this mass, after removal by a snare and cutting-forceps, proved to be typical thyroid tissue. Nevertheless, I am informed that symptoms indicating malignant disease subsequently developed.

Prolapse of the Laryngeal Ventricle. The mucosa which lines the ventricles of Morgagni is attached to the inner surface of the thyroid cartilage. Loosening of the attachment gradually or by violent cough may permit an eversion or turning outward of the pouch. This is not a neoplasm; but is considered in this section as a matter of convenience with respect to diagnosis and treatment. It is so rare that its existence is doubted by certain authors who maintain that veritable neoplasms, as well as syphilitic and tuberculous infiltrations, have been mistaken for it. The latter are certainly predisposing conditions, since most of the reported cases[10] [11] have been either syphilitic or tuberculous. Lefferts[12] made a thyrotomy in his case, abscised the projecting membrane, and found it to be an everted ventricle, so that the possibility must be admitted. Elsberg[1] and Cohen[2] also report cases. Dysphonia and moderate dyspnœa are the salient symptoms. Temporary replacement of the ventricular membrane by a probe, and its rounded, soft, smooth contour projecting from the position of the ventricle are the chief diagnostic features. The treatment is by abscission, evulsion, or cauterization, the same as for a real neoplasm.

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[1] Asch. Transactions of American Laryngological Association, 1884, p. 66.

[2] Ingals. Transactions of American Laryngological Association, 1888, p. 126.

[3] v. Bruns; cited by Schroetter, Krankheiten des Kehlkopfes, 1893, S. 275.

[4] Morell Mackenzie; cited by Jurasz, loc. cit.

[5] Schmiegelow. Revue de Laryngologie, 1891, Heymann's Handbuch, Band i., S. 814.

[6] Jonathan Wright. Loc. cit.

[7] Baurowicz. Archiv f. Laryngologie und Rhinologie, 1898, Band viii., S. 362.

[8] Paltauf. Ziegler's Beiträge, 1892, Band xi., S. 71; cited by Baurowicz, loc. cit.

[9] Freer. Journal of the American Medical Association, March 30, 1891, p. 877.

[10] Mapor. Transactions American Laryngological Association, 1886, p. 117.

[11] Guggenheim. Internat. Centralblatt f. Laryngol., Rhinol., etc., vol. viii. p. 127.

[12] Lefferts. Medical Record, 1876, p. 359.

Malignant Neoplasms of the Larynx. Carcinoma of the Larynx. Carcinoma, when originating and confined strictly within the framework of the larynx, is termed *intrinsic* or endolaryngeal cancer. When it attacks even the superior border of the larynx, so as to involve necessarily parts of the lower pharynx, and when it extends from the tonsil, lingual base, or pyriform sinus, it is termed *extrinsic* or pharyngolaryngeal carcinoma. This distinction is of importance, because the intrinsic type is more amenable to operative treatment. It is much slower to involve the cervical lymphatic glands. Of Butlin's[3] 14 cases the glands were affected in but 2 at the time of operation. This is explained by the fact[4] that the lymphatic vessels within the larynx, while present, are much attenuated, so that at the level of the ventricular bands, and especially the vocal cords, it is difficult to inject them.

Etiology. As with cancer elsewhere, the direct cause is unknown. The microbic, that is, the protozoan infection theory, while plausible, is not yet wholly substantiated. General predisposing conditions are heredity, which is traceable in about one-fourth of the cases, the male sex in the proportion of four to one, and mature age, an analysis[5] of 486 cases showing 40 per cent. between fifty and sixty years, and 84 per cent. between forty and seventy years, with but 15 per cent. between twenty and forty years. Laryngeal syphilis, tuberculosis, and chronic laryngitis, including pachydermia laryngis, by maintaining local irritation seem to act slightly as predisposants. Tobacco and alcohol figure only inappreciably. Without implying a change of type of tissues, it is clinically observed that benign growths and inflammatory tissue occasionally become the site, that is, furnish a suitable nidus for the development of malignant tumors. Thus is explained the so-called transformation of benign laryngeal neoplasms into malignant ones,[6] which, however, is so rare that the alleged influence of intralaryngeal operations must be practically nil.[7]

Pathology. The most frequent type is squamous-celled carcinoma (epithelioma), although cylindrical-celled carcinoma[8] is encountered with rarity. Other types about in the order named are soft glandular carcinoma (encephaloid) and hard glandular carcinoma (scirrhus). When intrinsic, favorite sites, primarily, are the vocal cord, ventricular band, and ventricle. It is primarily unilateral, but may become asymmetrically bilateral by contact infection or otherwise.

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[1] Elsberg. Archives of Laryngology, vol. iii., No. 1, p. 66.

[2] Cohen. Archives of Laryngology, vol. iii., No. 1, p. 67.

[3] Butlin; cited by Bosworth, Diseases of the Nose and Throat, vol. ii. p. 751.

[4] Sappey's Atlas. Vaisseaux Lymphatiques chez l'Homme, Paris, 1895; cited by Lennox Browne.

[5] Sendziak. Bösartige Geschwülste des Kehlkopfs.

[6] Ward, M. R. Pittsburg.

[7] Semon-Sammelforschung. Internationales Centralblatt f. Laryngologie, etc., 1888.

[8] Sendziak. Op. cit., S. 19.

Symptoms. Vocal impairment, a sense of laryngeal discomfort, and slight cough are the first and perhaps the only symptoms for months or years. Later dyspnœa and hemorrhage ensue, the latter when the ulcerative stage is reached; at the same time the secretion, perhaps previously augmented, becomes more copious, thick, viscid, and foul, imparting to the breath the peculiar odor of malignant disease. In extrinsic cases pain, especially on deglutition, and reflected toward the ear, is a prominent symptom.

On examination in the more common diffused form, the carcinoma is observed to spread over and through considerable surface, at first a mere thickening of the tissue, later becoming irregularly nodular, and of mottled reddish-yellow hues. Exceptionally the surface appearance is papillomatous, chalk-like, or snow-white,[1] or it may be quite smooth, lending to a tumor of reddish hue the appearance of a fibroma.

FIG. 459.

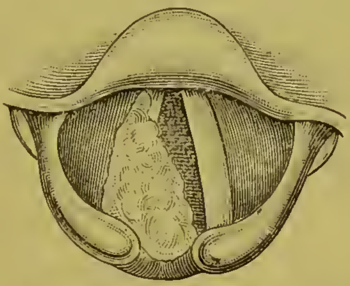

FIG. 460.

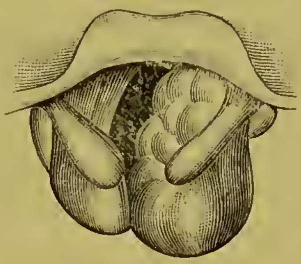

FIG. 459.—Squamous-celled carcinoma (epithelioma) of the larynx. (COHEN.)
FIG. 460.—Medullary carcinoma of the larynx. (COHEN.)

The so-called *carcinoma polypoides*[2] primarily affects the vocal cord only, and, while not circumscribed nor superficial, like benign neoplasms, has a broad-based elevation of more or less limited contour. Late cases which have extended from one part to another present advanced degrees of distortion, tumefaction, and ulceration of the parts.

Diagnosis. Benign neoplasms, especially papilloma and fibroma, if not pedunculated, are superficially situated, not interfering with the free motion of the cord, while in carcinoma the substructure is infiltrated and swollen, causing a "lazy" motion of the cord, which, however, is not invariably observable. It may be situated at any point, but is the more suspicious when, in an elderly individual, it is found upon the posterior third of the vocal cord. The carcinomatous surface when simulating papilloma is softer and more vascular. A microscopic examination of a fragment removed when it exhibits a positively carcinomatous structure is conclusive, but a negative result does not with certainty exclude carcinoma, for the reason that the fragment may represent only a papillomatoid surface of an underlying carcinoma. This is obviated by submitting a fragment from the depth of the neoplasm; but still other histological[1] [2] errors are possible, so that for a final diagnosis it is a safe rule to insist upon a degree of harmony between the microscopic findings and clinical aspects.

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[1] Gleitsmann. Transactions of American Laryngological Association, 1896.

[2] Fränkel: cited by Sendziak, op. cit.

Pachydermia is usually symmetrically bilateral and affects the vocal processes particularly, with an oval-cupped infiltration.

Syphilis, when not characteristic or distinguishable by concomitant symptoms, may be differentiated from carcinoma by the therapeutic effect of potassium iodide, it being remembered that cancerous infiltration will also recede at first under this drug, but only slightly and for a brief period.

Tuberculosis enters the question only in atypical cases when devoid of concomitant pulmonary symptoms, bacilli, and local pallor. It may be unilateral, but is prone to affect first the arytenoid eminence and posterior part of the vocal cord. The ulceration appears earlier, and is of the mouse-nibbled type.

It is possible for carcinoma to develop in a tuberculous larynx,[3] also in connection with long-standing chronic laryngitis[4] and in syphilitic subjects,[5] conditions which render the diagnosis the more difficult.

Prognosis. The natural course toward a fatal termination is comparatively slow. Eight years is not an unusual period. An early diagnosis and prompt operative interference afford a chance of recovery, but at the expense of deformity of the throat and some immediate risk to life.

Treatment. Notwithstanding occasional cases reported[6] favorably, endolaryngeal operating is suitable only for diagnostic and palliative purposes, the exception being when the tumor is strictly circumscribed, "polypoid" in formation, superficial, and accessible, very rare conditions, even in the earliest stage. It is justifiable to remove segments by the cutting-forceps or double curette for microscopic examination, and in inoperable cases the lumen of the larynx may be kept clear in like manner, but, as a rule, one of the external operations should be urged early. It is impossible to determine by the mirror the extent of cancerous infiltration, certain recesses are inaccessible to intralaryngeal methods, and, besides, one is without means of controlling possible hemorrhage.[7] A false hope is engendered by repeated inadequate removals which delay radical measures until too late or until, heart-sick by hope deferred, the patient rejects further operative aid.

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[1] Chiari, O. Archiv f. Laryngologie und Rhinologie, Band viii., Heft 1, S. 68.

[2] Fränkel; cited by Chiari, op. cit.

[3] Chiari. Archiv f. Laryngologie und Rhinologie, Band viii., Heft 2.

[4] Chiari. Loc. cit., Fall xi.

[5] Chiari. Loc. cit., Fall xi.

[6] Fränkel, B. Archiv f. Laryngologie und Rhinologie, Band vi., S. 361.

[7] Noltenius. Op. cit., Band viii., S. 128.

Thyrotomy, the least formidable of the external operations, is the best when the carcinoma is wholly within the larynx, confined chiefly to one vocal cord or ventricular band, and without extending so deeply as to involve the cartilage. Also as a diagnostic method it may immediately precede total or partial laryngectomy whenever there is the least doubt of the necessity of such operations.

Modern statistics[1][2][3] are favorable to this operation for early cases limited to one vocal cord or ventricular band, showing 9 to 14 per cent. of absolute recoveries (three years), 13 to 42 per cent. additional of relative recoveries (one year), with 9 to 18 per cent. of deaths from the operation.

Partial resection of the larynx, meaning the removal usually of a lateral half of the thyroid and cricoid, is adapted only to strictly intralaryngeal and unilateral carcinoma. It has been sought to substitute it for complete laryngectomy when these conditions permitted, because the risk of septic pneumonia is less, and deglutition, respiration, and even vocalization are resumed. It can be utilized for cases slightly more extensive than those suitable for thyrotomy, but should not be relied upon where there is any suspicion of involvement of both sides or in laryngopharyngeal cases. One hundred and ten cases tabulated[4] since 1876 show 9 per cent. recoveries (three years), 12 per cent. relative recoveries (one year), 28 per cent. recurrences, and 26 per cent. of deaths in consequence of the operation. Two later series, one of 57 cases[5] and one of 50 cases,[6] since 1890, give an improvement showing 12 to 16 per cent. recoveries, 32 per cent. relative recoveries, 36 per cent. recurrences, and 16 to 28 per cent. of operative fatalities.

Laryngectomy, or complete extirpation of the larynx, is indicated when the carcinoma, while confined to the larynx, involves so much of that organ that no part can be saved without risk of recurrence. If the epiglottis is positively healthy it can be retained and utilized by Swain's[7] method to form an anterior wall to the œsophagus and close the pharynx from the windpipe. The greatest danger of laryngectomy is septic pneumonia from the inspiration of discharges from the wound and secretions of the throat, and this is prevented by leaving no opening; but, as a rule, the retention of the epiglottis favors recurrence (26 cases, 2 recoveries),[8] and the same end can be accomplished as in Cohen's case[9] and others[10] by stitching the upper end of the trachea, slit open in front, to the skin of the neck at the bottom of the incision. This precludes respiration by the mouth and the wearing of an artificial larynx, but lessens the danger and conduces to comfort by non-interference with deglutition. A buccal voice is prone to develop, which enables the patient to make himself understood.

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[1] Sendziak; cited by Chiari, op. cit.

[2] Schmiegelow; cited by Chiari, op. cit.

[3] Delavan. Transactions of American Laryngologial Association, 1900, p. 71.

[4] Sendziak. Bösartige Geschwülste des Kehlkopfes, 1897.

[5] Delavan. Transactions of American Laryngological Association, 1900, p. 71.

[6] Schmiegelow; cited by Chiari, loc. cit.

[7] Swain. Transactions of American Laryngological Association, 1891, p. 115.

[8] Sendziak. Bösartige Geschwülste des Kehlkopfs, S. 171.

[9] J. Solis Cohen. Archiv f. Laryngologie und Rhinologie, Band i., S. 278.

[10] Glück. Berliner klin. Wochenschrift, 1897, S. 922.

The statistics of total extirpation of the larynx have improved with modern methods. Fifty cases tabulated[1] since 1890 give 10 per cent. recoveries (three years), 48 per cent. relative recoveries (one year), 20 per cent. recurrences, and 22 per cent. operative fatalities (two months). Delavan's[2] series of 34 cases from seven operators since 1890 gives 6 per cent. of recoveries, and 26 per cent. of operative deaths.

Sources of danger other than pneumonia are shock, damage to branches of the pneumogastric nerve, affecting the heart and circulation; exhaustion, and hemorrhage. It is still a hazardous operation the advantages and disadvantages of which should be fully explained to the patient.

Subhyoid pharyngotomy is indicated only for tumors of the epiglottis, pyriform sinuses, or lower pharynx when not properly removable through the mouth.

Tracheotomy alone serves to prolong life in inoperable cases, those in which the pathological process is too widely distributed, or the patient in an enfeebled state, and in those in which a radical operation is declined. Of six cases seen by the author, in four, two intrinsic and two extrinsic, this last resort was the only suitable remedy at the time they first appeared, late in the course of the disease. It is often thus. Usually the canula should be inserted below the isthmus of the thyroid gland, in order to escape the descending laryngeal infiltration, and for permanent use a tracheotomy tube of soft rubber is better tolerated than the customary metallic one.

Gastrostomy may prolong life a trifle when exhaustion is imminent because of dysphagia.

Palliative Measures. An alkaline antiseptic spray may be preceded by a 1 per cent. cocaine spray, and supplemented by additional sedatives and emollients. Orthoform applied as in laryngeal tuberculosis gives the most enduring relief from pain. Potassium permanganate in 1 per cent. solution is an efficient deodorizer.

Sarcoma of the Larynx. Much that has been said with reference to carcinoma applies also to sarcoma of the larynx. The clinical course is similar. It is more rare, in the proportion of one to twelve. The comparison with all other laryngeal neoplasms[3] is three to five hundred and forty-eight, nevertheless, a series of 50 cases or more is readily collected from modern literature. The author has observed but one case, that of:

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[1] Schmiegelow; cited by O. Chiari, loc cit.

[2] Delavan. Transactions of American Laryngological Association, 1900, p. 72.

[3] Moritz-Schmidt; cited by Sendziak, op. cit., p. 194.

Mr. O. R., of Seattle, Washington, forty years of age, upon whom Hahn had performed thyrotomy in Europe six months previously for the purpose of extirpating a malignant growth which proved to be spindle-celled sarcoma. At the time of my examination, while on his way home, a recurrence had already taken place, a granulomatous mass occupying much of the lumen of the larynx. He declined an operation in Chicago, and continued his journey in despair. (Plate XXVIII., Fig. 2.)

Sarcoma may originate in the order named from the vocal cord, epiglottis, aryepiglottic fold, false cord, ventricle, and pyriform sinus. Also from the subglottic region and trachea, or it may be extrinsic, having extended to or from the pharynx. The usual types are spindle-celled, round-celled, and alveolar sarcoma, although every possible sarcomatous combination has been recorded. For a further description of these, and for the etiology of sarcoma in general, references may be made to the chapter on intranasal sarcoma. It is more frequent in early life than carcinoma, but those of mature age, thirty to sixty years, furnish the majority of cases, proportionately increasing in each decade. Men are affected in the ratio of three to one.

The salient symptoms, such as cough, hoarseness, and especially pain, are less pronounced than with carcinoma, and the glands are even less likely to be affected until late.

On examination one finds usually a diffused, smooth, nodulated or warty tumor. More rarely it is circumscribed, even pedunculated, and then proceeds from the vocal cord. The color runs from bright red through yellowish tints to gray, and the consistency varies according to the type, from a creaking hardness to a cauliflower-like formation. It is usually single, but may be multiple.

Diagnosis. Carcinoma can be excluded only by a microscopic examination. The polypoid or pedunculated type may simulate fibroma, but can be differentiated in the same way. Not so, however, with syphilis, for gummatous infiltrations in section resemble round-celled sarcoma. The effect of potassium iodide should be noted and a degree of harmony established between the microscopic findings and the clinical course and aspects.

The prognosis is less unfavorable than with carcinoma; but it all depends upon the possibility of an early and thorough extirpation. An analysis of 50 cases[1] shows 12 per cent. recoveries (three years), and 24 per cent. relative recoveries (one year), with fewer immediate fatalities from the various operations than with carcinoma.

Treatment. The principles underlying the selection of an operation and the technique are the same as for laryngeal carcinoma, to which subject reference should be made. Medicinal means especially adapted to inoperable cases are there mentioned. In addition injections of mercury bichloride, 2 per cent. solution in olive oil, and 1 per cent. pyoktanin externally have been commended.

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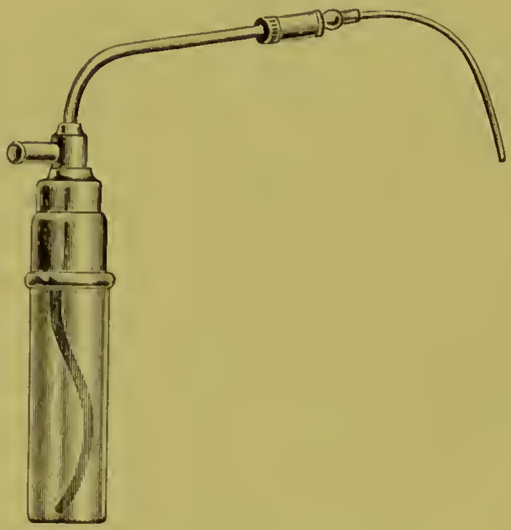
[1] Sendziak. Op. cit., S. 218.

THE LOCAL, MEDICINAL, AND SURGICAL TREATMENT OF THE LARYNX.

Medicinal substances may be applied to the larynx in the form of spray, medicated air, vapor or fumes, pigment or paint, powder, syringed fluid, and submucous injection. The larynx may be sprayed by the ordinary straight-tipped atomizer by taking forced inhalations while the head is thrown backward, the tongue protruded, and the nose closed. Nebulized oil is readily inhaled thus, while aqueous sprays soon excite cough which, however, is evidence that the spray has actually entered the larynx. The short angular downward atomizer-tip is sometimes of service, but Freer has devised a curved attachment for the Davidson spray tube, sufficiently long to actually enter the larynx, which in skilful hands is still more useful. (Fig. 461.)

FIG. 461.

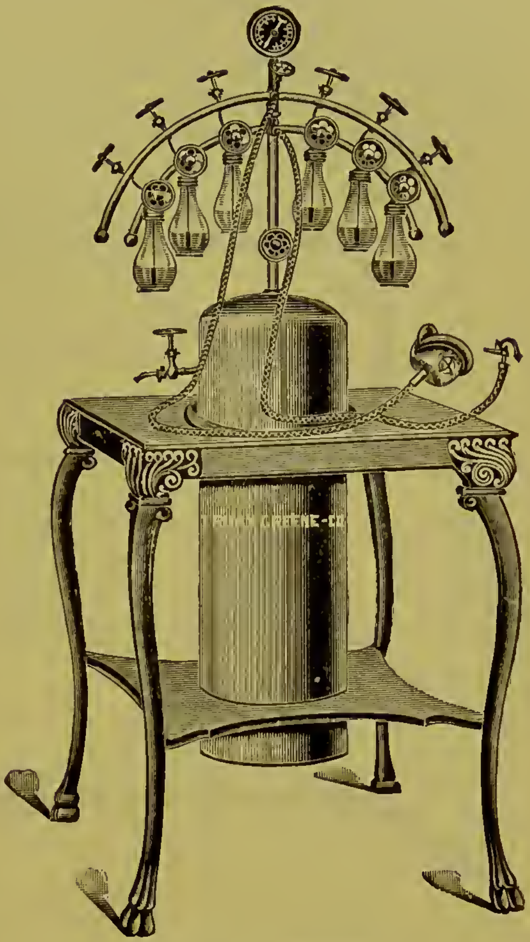


Showing Freer's laryngeal spray-tube attached to a Davidson atomizer.

For a decided emollient effect the actual atomization of oils by means of a powerful double-ball hand atomizer of the Davidson type, or one operated by machine compressed air, is preferable to the more finely divided oil vaporization which is furnished by special "oil atomizers," "oil nebulizers," and "inhalers." The latter class of inhaler of the globe pattern is now arranged in multiple for attachment to the compressed air tank. Its actual usefulness seems to me quite limited, perhaps being beneficial in acute laryngobronchial inflammation and as an occasional means of inducing respiratory gymnastics. (Fig. 462.) The "atomizing vaporizer" of Thomas is more efficient because the spray is more copious. (Fig. 463.) The steam atomizer is at present little used. A hot laryngeal spray is objectionable before going out in the cold, but may be serviceable for the first stage of acute laryngitis, when the patient is confined, and for evening applications. The same may be said of medicinally impregnated hot-water or steam vapor inhalations. The latter can be extemporized by the use of a fruit-jar half filled with water just short of a boiling temperature, and covered with a glass funnel. The sedative properties of the vapor itself in the earliest stage of an acute inflammation of the larynx and contiguous parts will be intensified by the addition, for instance, of thirty grains of lupulin.

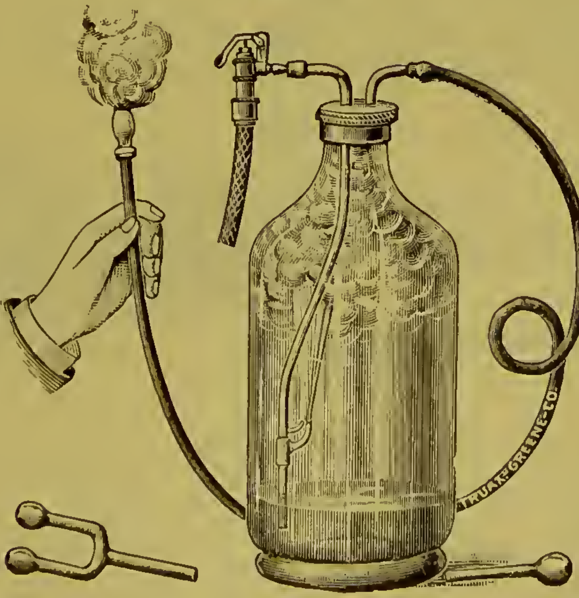
Swabbing the larynx, that is, the application of a pigment or medicinal paint, is made by a pledget of cotton firmly secured to an applicator. Brushes are no longer used for this purpose, because they cannot be rendered aseptic. The applicator should be sufficiently strong to maintain a fixed angular bend. Cohen's forceps (Fig. 464) and Freer's

FIG. 462.



Traux multiple nebulizer.

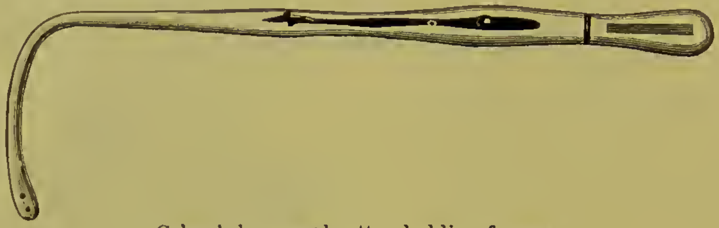
FIG. 463.



Thomas' atomizing vaporizer.

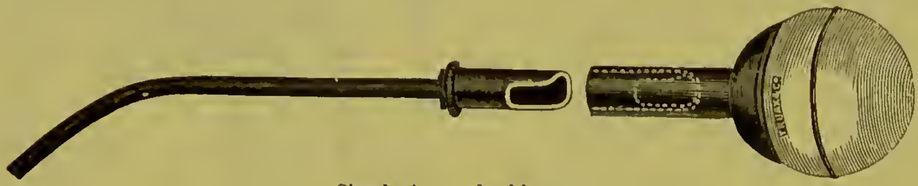
steel rod are satisfactory. The latter's firmness is an advantage in applying lactic acid with friction for laryngeal tuberculosis. There is less resort to painting the larynx than formerly, since it is recognized that the impact of the swab is in itself an irritant; nevertheless, the process is very useful, with astringents and resolvents, for certain forms of subacute and chronic laryngitis, also with lactic acid, etc., for tuberculosis, and with cocaine for the production of local anaesthesia. The swab is applied under laryngoscopic observation at the moment when the epiglottis is raised by phonation.

FIG. 464.



Cohen's laryngeal cotton-holding forceps.

FIG. 465.

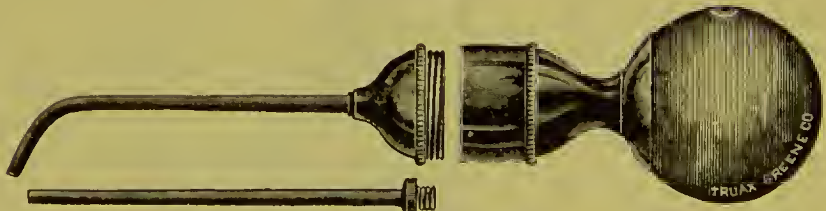


Shurley's powder-blower.

The insufflation of powder into the larynx is accomplished by means of a powder-blower. (Figs. 465 and 466.) It should have a detachable end for sterilization.

The insufflation is made under laryngoscopic observation and while the patient phonates to raise the epiglottis, the powder being blown from behind forward and downward. This method is useful, among other conditions, for persistent subacute laryngitis, alum diluted with an equal part of acacia being insufflated.

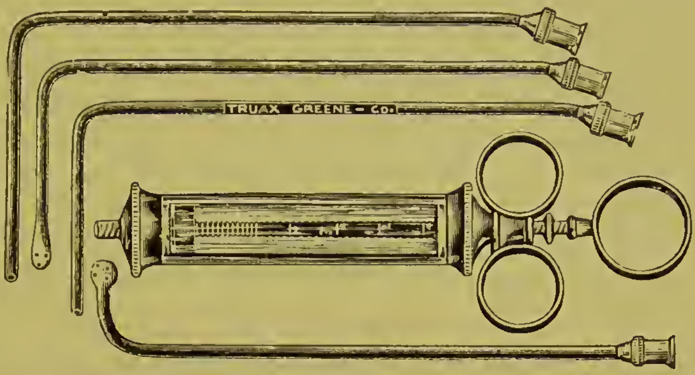
FIG. 466.



Greene's powder-blower.

Oils, especially "oil vaseline" and other petroleum products, can be slowly syringed into and through the larynx without provoking much spasm. From 2 to 6 gm. of an antiseptic or stimulating emollient mixture may be thus injected at a dose. A syringe with a long angular laryngeal tube is requisite. (Fig. 467.) The larynx should first be sprayed with a 2 per cent. cocaine solution. Even aqueous solutions, if bland, can be injected after cocainization. The method is useful for chronic tracheitis and laryngitis sicca and for fetid bronchitis.

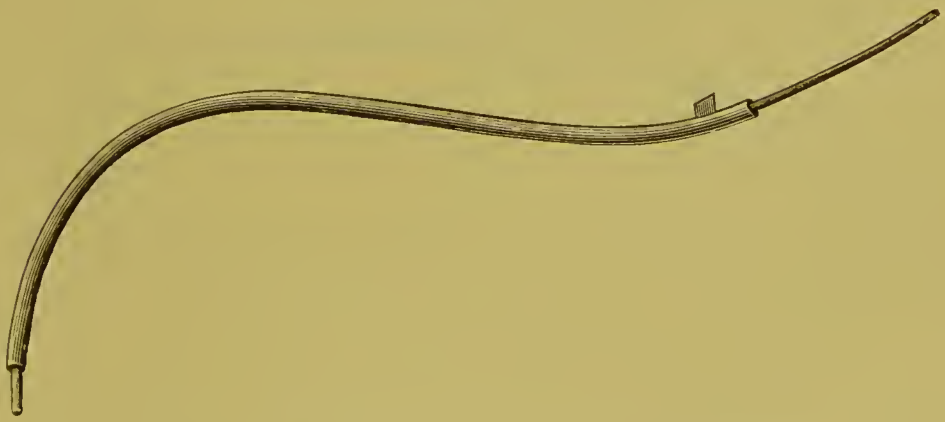
FIG. 467.



Moreau Brown's laryngeal syringe.

Submucous injection in the larynx is employed for the production of thorough local anæsthesia by cocaine preceding certain endolaryngeal operations and to promote absorption of tuberculous infiltration by creasote, guaiacol, etc. Chappell's syringe is well adapted to the latter purpose. The needle shank is six inches long, and may be given suitable curves; the needle itself is half an inch in length, with the opening close to the point. The piston can be disengaged by a thumb-button when it is automatically pushed home by a spring. A set-screw regulates the dose, usually one drop. Heryng's syringe is an excellent instrument without the automatic piston.

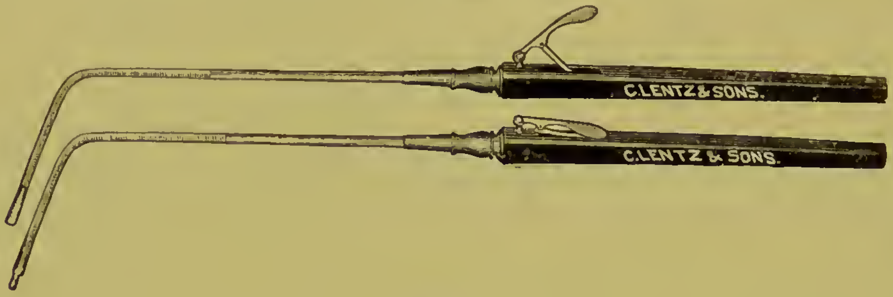
FIG. 468.



Author's laryngeal porte caustique adapted to Schroetter's handle.

Chemical Cauterization. For the application of either chromic acid or solid nitrate of silver to a circumscribed spot in the larynx these substances should be fused in a small bead upon the end of a shielded applicator. The tubular shield should cover the bead during the introduction of the instrument, being withdrawn to expose the caustic point only when the latter has reached the exact spot to be cauterized. (Figs. 468 and 469.) This method is properly available only in a tolerant locally anæsthetized larynx and under perfect laryngoscopic observation. It is exceptionally used for the destruction of small benign neoplasms or for the cauterization of the base after the removal of a growth by forceps. Ingals[1] reports favorable results in a case of chondroma. As a rule, the galvanocautery is a better means to the same end.

FIG. 469.



McCoy's laryngeal porte caustique.

Surgical Methods. Endolaryngeal surgical procedures include scarification and incision, curettement, evulsion and abscission by forceps, ecrasement, galvanocauterization, and electrolysis. The appliances are most employed and best described in connection with the treatment of benign neoplasms, laryngeal tuberculosis, cicatricial stenosis, foreign bodies, etc.

Local Anæsthesia. Before the introduction of cocaine it was necessary to train the larynx to tolerate instrumental manipulation by a course of daily contacts with a probe. Cocaine anæsthesia obviates this necessity, if not wholly, then in part. The degree of anæsthesia obtainable depends in a measure upon the method of application. The cocaine solutions, 5, 10, and 20 per cent., should be freshly prepared. The 5 per cent. solution is sprayed sparingly first from a straight tip through the pharynx, being forcibly inhaled into the larynx, and after an interval of three minutes again sprayed directly into the larynx by Freer's nozzle. The 10 per cent. solution is applied by a cotton applicator after a second interval of about four minutes, and the 20 per cent. solution is used in like manner after a third interval. Including a fourth period of rest, the whole time consumed aggregates about fifteen minutes. The patient previously should have been tested for supersensitiveness to cocaine. Very strong solutions will occasionally irritate more than anæsthetize, in which event the limit should be from 5 to 10 per cent. Swabbing also must exceptionally be avoided for the same reason. For deep curettement and for the excision by the double curette of tuberculous sites the immediate area is further anæsthetized by submucous injection of a drop here and there of a 2 to 4 per cent. solution.

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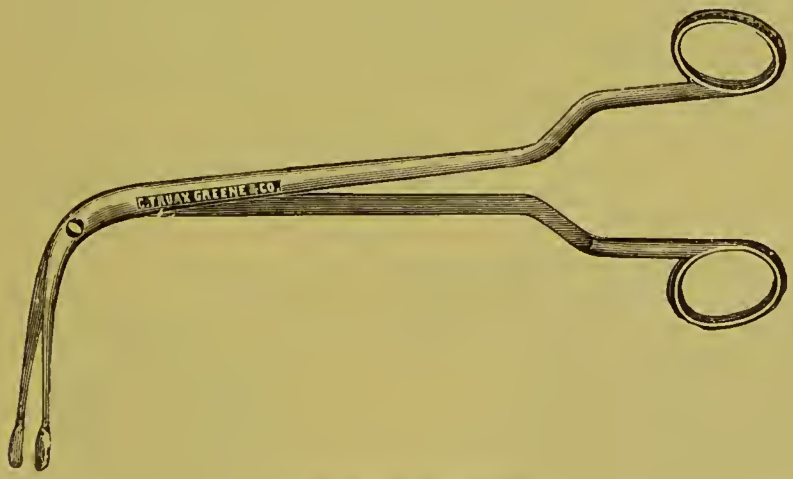
[1] Transactions of American Laryngological Association, 1888, p. 126.

The Removal of Papillomata and Other Benign Neoplasms. Foreign Bodies. Singers' Nodes. Pachydermia. The patient protrudes his tongue and steadies it with a napkin between the thumb and first finger, while the surgeon, seated somewhat higher than the patient, holds the throat-mirror in position with one hand, and with the other passes the forceps, snare, or cautery electrode around the epiglottis without touching it, and well downward and forward to the site of the growth. The forceps is quickly opened and the growth firmly grasped. Just at this moment or before the larynx is apt to close. If the forceps is already in exact position this spasm will not prevent the grasping and withdrawal of the neoplasm, but if not, one must desist and try again; the attempt may be made either during respiration or on phonation. I have been more successful in the former position of the larynx, but an overhanging epiglottis must often be pressed forward by the forceps. The latter position is adapted to growths which rise well above the glottis on phonation.

The forceps are of two general types, bladed pivot forceps and tubular forceps. In the former the laryngeal bend may be approximately a right angle or a curve. Blades are constructed to open both antero-posteriorly and laterally, the latter motion being very important for growths at the anterior commissure and for foreign bodies in certain positions. The grasping ends are made with cutting edges and with simply serrated surfaces. Dundas Grant has modified the pivot forceps by hinging together the distal ends of the cutting blades. (Fig. 472.)

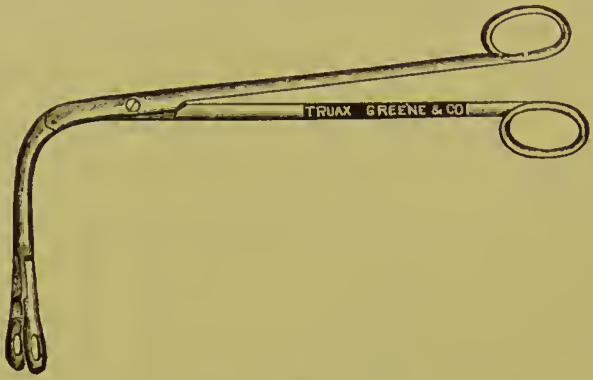
FIG. 470.



Mackenzie's cutting forceps.

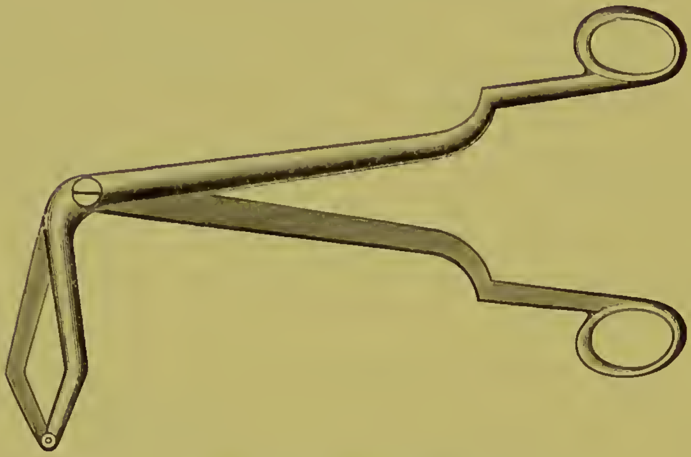
The obstruction to vision by tubular forceps is less; but the movement of the blades is limited and they are suited rather to quite small growths. Those of Schroetter, Stoerk, Seiler, and Krause are most favorably known. Seiler's tube is flexible, and is therefore adaptable

FIG. 471.



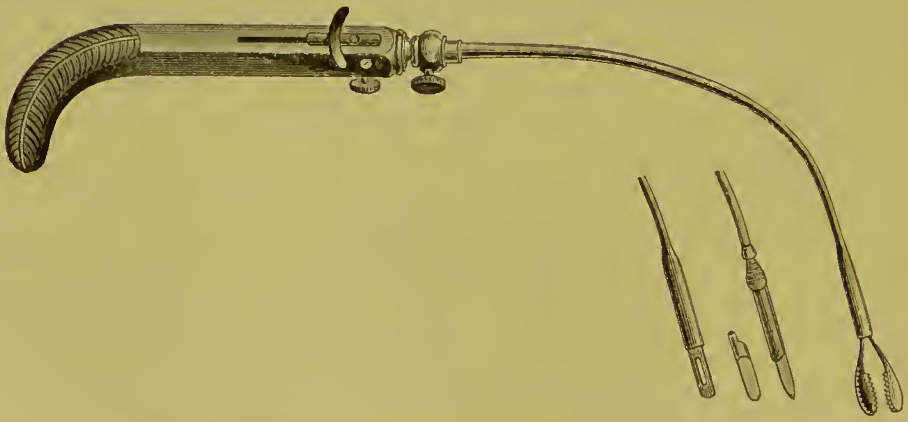
Cuseo's laryngeal forceps.

FIG. 472.



Dundas Grant's guarded forceps.

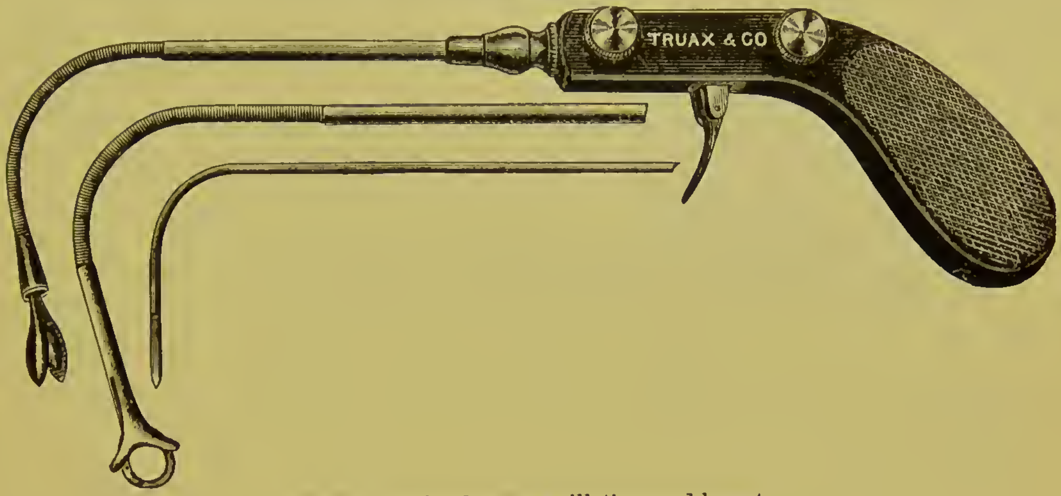
FIG. 473.



Schroetter's handle, containing serrated forceps. Two sheathed knives and a sheathed caustic applicator are also shown.

for bronchial and œsophageal uses—*e. g.*, the removal of a foreign body through a tracheal opening. (Fig. 474.)

Fig. 474.



Seiler's tubular forceps, guillotine, and lancet.

A small guillotine which forms part of the tubular outfit is suitable for the removal of readily encircled tumors. A laryngeal lancet also conveniently forms one of the tubular attachments. The tube acts as a shield within which the small knife is concealed during passage into the larynx, to be protruded at will when the desired spot is reached. It is employed for scarification and puncture in œdema of the larynx and for the division of adhesions.

The "*double curettes*" of Krause and Heryng are in reality sharp-cutting and punch-forceps, which operate on the tubular plan. They are available for the removal of neoplasms, although they were designed for the eradication of areas of tuberculous infiltration, a subject which is considered in another chapter.

Laryngeal forceps are employed also for the removal of foreign bodies both from the larynx and laryngopharynx. These objects,

Fig. 475.

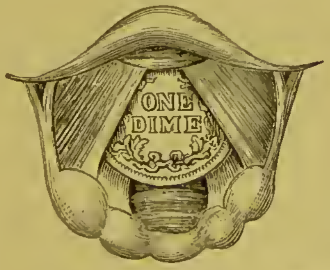
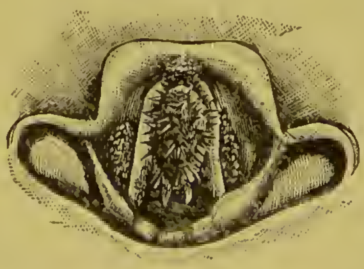


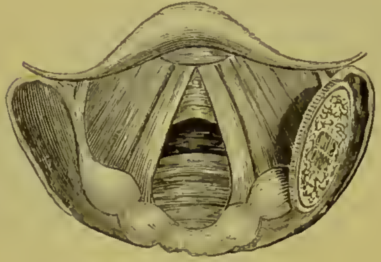
Fig. 476.



Foreign bodies in the larynx.

including coins, fish-bones, pins, tacks, cockle-burs, buttons, nutshells, beans, jackstones, teeth, etc., being of all shapes and sizes and in varying situations, one selects whatever implement seems best adapted to the individual case. The method as regards local anæsthesia and the introduction of the forceps is the same as for the removal of neoplasms. Living objects, such as lumbricoides, hydatids, and leeches, occasionally gain access to the air passages. Large objects, such as apple-cores, pieces of meat, and tooth-plates may occlude the larynx by becoming impacted in the pharynx. They can usually be dislodged by the finger, but laryngeal forceps may be required. In children extraction, even from within the larynx, may often be made, guided by the finger, under general anæsthesia. Foreign bodies which are lodged in the trachea or in one of the main bronchi can usually be grasped by straight or slightly-curved forceps introduced through a low tracheotomy wound.

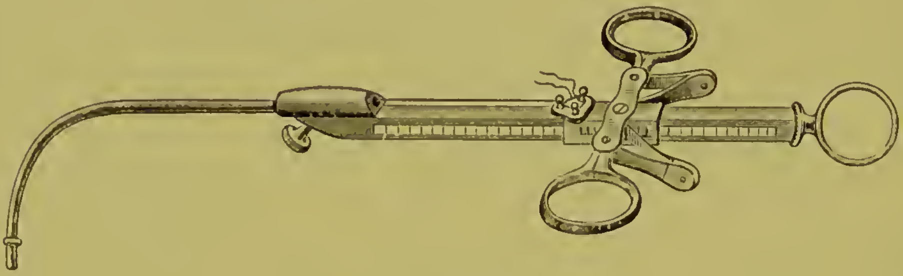
FIG. 477.



Foreign body in the larynx.

Ecrasement or the use of a cold wire snare is best adapted to pedunculated neoplasms of good size, especially papillomata, fibromata, and cysts. A canula with a laryngeal curve can be adapted to a nasal snare. (Fig. 478.)

FIG. 478.

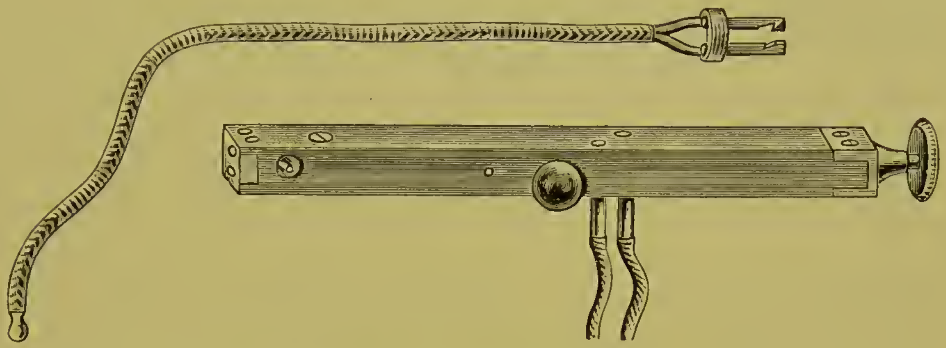


Casselberry's modified Allen snare.

When a papilloma is broad-based and deeply inserted in a situation rather inaccessible to forceps, as in part beneath a vocal cord, it may be destroyed *in situ* by the galvanocautery. The author's experience includes several cases of this sort in which the forceps operation seemed like pulling pieces from a cutaneous "seed wart." The more one pulled the faster it grew. The accompanying figure represents an electrode which is well adapted to this purpose. Its platinum loop is turned to one side or the other, which renders unnecessary a shield to protect the opposite cord. The platinum tip while cold is pressed laterally upon the growth and then caused to glow for a second only. Sajous' handle, which is light and has the cords suspended from its middle, has the best balance for laryngeal use. (Fig. 479.)

Sessile angiomata, small fibromata, polyps, cysts, and tuberculous granulomata can be destroyed in the same way by an expert hand. Persistent singers' nodes, especially those which are too minute and too intimately blended with the substance of the vocal cords to be detached by forceps, may be treated by the cautery electrode, although extreme care is requisite. Those nodes which project sufficiently and the larger nodules of chorditis tuberosa can be detached by cutting-forceps, especially Grant's guarded forceps.

Fig. 479.



Casselberry's laryngeal electrode and Sajous' handle.

Curettement of the larynx is employed chiefly in the surgical treatment of tuberculosis and receives appropriate mention under that heading. Heryng's single curettes are suitable, being well made, sharp, and of varying sizes. Papillomata, when diffused, and when inaccessible to forceps, can occasionally be effectually curetted. Simple inflammatory and syphilitic infiltrations, and pachydermia laryngis are somewhat rarely amenable to the same treatment. In pachydermia, curettement is usually supplemented by chemical cauterization, either by lactic acid on a cotton swab or chromic acid fused in a bead on a porte caustique. Salicylic acid, 10 per cent., in alcohol and water, is also commended.

Electrolysis by the bipolar method is recommended by Chiari for pachydermia diffusa (*Journal of Laryngology*, May, 1894). The iridoplatinum needles designed by the writer for nasal use are suitable if given the laryngeal angle. A current of from eight to twelve milliampères is adequate. Cupric electrolysis applied by a bulbous positive electrode of copper with a current of five milliampères is advocated by Scheppegrell for laryngeal tuberculosis. Oxychloride of copper is liberated in the tissues.

Injuries of the Larynx. Injuries of the larynx may occur in consequence of either internal or external violence. Traumatism from within can result from extreme muscular action, the impaction of foreign bodies, the application of surgical appliances, either intentionally or unintentionally—*e. g.*, the false passage of an intubation tube, the swallowing of corrosive liquids, and the inhalation of scalding vapor. Injuries from without include gunshot wounds, incised wounds as in cut-throat, punctured wounds as in sword and hay-fork thrusts, fracture, dislocation, and contusion as from throttling, hanging, and accidental blows.

Violent coughing and shouting sometimes injures one or both vocal cords in such a manner that they present an ecchymotic and paretic appearance. Rest and an emollient spray are indicated. Sharp-cornered foreign bodies occasionally lacerate the interior of the larynx, especially during forcible extraction; such wounds usually heal readily under antiseptic and emollient sprays, but it is possible for an abscess, perichondritis, and œdema to be excited in this way. Bokay[1] reports that out of 1200 cases of intubation of the larynx observed by him there were four cases of false passage, all in the ventricle and all fatal. The false passage may also be forced through the membrana thyrohyoidea. Œdema, suppuration, and perichondritis are very prone to follow. Tracheotomy should be immediately substituted for intubation. The ulceration and pressure necrosis which occasionally results from the prolonged use of intubation tubes merely requires mention in this connection. It is rarely serious, but very exceptionally may be followed by cicatricial stenosis. The same is true of high tracheotomy when the tube is so placed that the upper curve impinges upon the inferior surface of the vocal cords. The author has recently observed a case in which a web extending largely across the glottis and an ankylosis of the left crico-arytenoid joint had resulted from this cause.

In the swallowing of corrosive liquids the epiglottis and aryepiglottic folds would be the only parts of the larynx directly affected, but obstructive œdema is likely to ensue. The inhalation of steam is fraught with the same danger.

Gunshot, punctured, and incised wounds from without vary in gravity according to their situation and extent, yet most of them do well if the hemorrhage is checked and the parts are cleansed and carefully coaptated. To avoid stenosis by the formation of a diaphragm, the divided cartilages should be deeply sutured by silkworm-gut. Emphysema of the neighboring connective tissue is sometimes a troublesome symptom.

Fracture of the larynx may be caused by a fall upon a projecting object, by a blow, and by hanging and choking. For instance, a man while riding a bicycle carried suspended around his neck the diamond-shaped frame of another bicycle. He fell and compressed his neck in the angle of the frame, which fractured the larynx in such a way as to result in immediate death from asphyxia. Fracture is rare, owing to the natural resiliency of the cartilaginous framework. The most serious symptom is dyspnœa, which is usually due to œdema of the glottis from laceration of the soft parts, but which may be caused by a displaced fragment encroaching upon the lumen of the larynx. It may set in at once or at any time within a week. Other manifestations are cough, bloody expectoration, impairment of the voice, emphysema, and pain both on talking and swallowing. By digital examination, deformity, mobility, and crepitation would be perceived, and the diagnosis thus certified. Laryngoscopic examination will disclose swelling and distortion within the larynx. The fracture may be linear or comminuted and may involve one or more cartilages. The prognosis is very serious, three-fourths of the recorded cases having terminated fatally,[1] either immediately or from subsequent pneumonia, abscess, and septicæmia.

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[1] Bokay. Traumatism during Intubation. Journal of American Medical Association, January 26, 1901.

The treatment should be directed toward the prompt relief of dyspnœa by low tracheotomy, provided there is time for a deliberate operation, or, if necessary, by a hasty high tracheotomy. Intubation as a substitute for tracheotomy is not suitable in these cases. Even if asphyxia is not at once imminent the patient should be kept under close surveillance, for it is liable to develop suddenly. Prompt replacement of the fragments, cold applications, and absolute rest, including feeding by the rectum, are indicated to ward off œdema. The hyoid bone being in close proximity to the larynx, may be fractured conjointly or alone from the same causes. The superior cornua of the thyroid cartilage are loosely articulated to the greater cornua of the hyoid bone through the medium of the thyrohyoid ligament. A displacement in the nature of a dislocation of this articulation occasionally occurs by muscular action in sudden movements of the neck. A return is usually effected in the same way by muscular movements, but digital manipulation will hasten it. Severe contusion of the larynx would suggest in part the same care as actual fracture.

[1] Bosworth. Diseases of the Nose and Throat, vol. ii. p. 712.

CHAPTER XXI.

DISEASES OF THE ACCESSORY SINUSES.

By StCLAIR THOMSON, M.D., M.R.C.P. Lond., F.R.C.S. Eng.

Introductory. With the exception of that part of the roof of the nasal chamber formed by the cribriform plate, the upper and outer walls of the nasal cavities are occupied by the accessory pneumatic sinuses. Contiguous to the outer wall of the nose are lodged the maxillary and ethmoidal cavities, while portions of the ethmoidal, frontal, and sphenoidal chambers help to form the nasal roof.

It would be a natural presumption that these cavities, communicating as they do with the nasal fossæ, exposed to a variety of possible etiological factors, and in close relationship with such important parts as the brain, eye, ear, and throat, would not be exempt from disease. They are indeed subject to disease just as the nasal fossæ are, but it would be a mistake to think, as some authors state, that since affections of the pituitary membrane can be propagated to the accessory cavities, the latter manifest just the same diseases. A little reflection would show that this view cannot be correct. The provision in the nose for filtering, warming, and moistening the inspired air necessitates special anatomical arrangements, which, when disordered, are subject to particular pathological changes. At the same time this continually renewed air stream brings with it pathogenic possibilities from which the accessory cavities are much more exempt. The mucous lining of the latter has not the same functions to perform, and is therefore differently arranged.

On the other hand, affections of the sinuses require individual consideration owing to (*a*) the shape of each cavity, (*b*) the situation of its orifice, and (*c*) its relation to neighboring organs. It will be noted that all these three factors pertain to anatomical characteristics, and hence the great importance of an exact practical acquaintance with the surgical anatomy of this region. It is seldom taught adequately in the dissecting-room, and the consideration of the surgical points in the anatomy of the sinuses hardly appeals to students sufficiently at an early period of their career to command much attention.

A correct idea of the topographical anatomy of the accessory sinuses can only be obtained by the study of both dry and moist sections. Every surgeon who aspires to a profound study of the diagnosis and treatment of nasal suppuration should lose no opportunity of examining a series of coronal, sagittal, and horizontal sections of the head, which he should, if possible, prepare with his own hands. Those who have not these opportunities can to some extent supplement them by the study of plaster casts,[1] while much can be gained from the numerous atlases and special treatises devoted to the subject.[2]

Surgical Anatomy of the Accessory Sinuses. Many of the important points of the topographical and surgical anatomy of the accessory sinuses are shown in the illustrations, and others will be referred to in treating of the diseases of the individual cavities. It will therefore be sufficient here to briefly refer to a few of the points which deserve special consideration.

From both anatomical and clinical considerations it is convenient to divide the accessory sinuses into two groups, according as to whether their *ostia* open (*a*) *anteriorly* into the middle meatus, below the attachment of the middle turbinal, or (*b*) *posteriorly* into the superior meatus and above the middle turbinal. Thus:

- Anterior group:
    - Maxillary sinus.
    - Frontal sinus.
    - Anterior ethmoidal cells.
- Posterior group:
    - Posterior ethmoidal cells.
    - Sphenoidal sinus.

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[1] Prepared by Dr. Betz, of Heilbronn, and sold by instrument dealers.

[2] John James Watt. Anatomico-chirurgical Views of the Nose, Mouth, Larynx, and Fauces. London, 1809.

Zuckerkandl's Anatomie Normale et Pathologique des Fosses Nasales et de leurs Annexes Pneumatiques. Traduction Française de Lichtwitz. Paris, G. Mason, 1895.

Onodi's Atlas of the Nasal Cavity and Sinuses, translated by StClair Thomson. London, H. K. Lewis, 1895.

Drs. R. Gougenheim et J. Glover. Atlas de Laryngologie et de Rhinologie. Paris, G. Mason, 1894.

Arthur Hartmann. Atlas der Anatomie der Stirnhöhle, der vorderen Siebeinzellen und des Ductus Nasofrontalis. Wiesbaden, J. W. Bergmann, 1900.

Dr. P. H Gerber. Atlas der Krankheiten der Nase, ihrer Nebenhöhlen und des Nasenrachenraumens. Berlin, S. Karger, 1901.

Dr. Robert Krieg. Atlas der Nasenkrankheiten. Stuttgart, Ferdinand Enke, 1901.

Logan Turner. The Accessory Cavities of the Nose. Edinburgh, Green, 1901.

J. H. Bryan. A Further Contribution to the Study of Suppurative Diseases of the Accessory Sinuses, with Report of Cases. Transactions of the American Laryngological Association, 1895, p. 76, and New York Medical Journal.

Howard A. Lothrop. The Anatomy and Surgery of the Frontal Sinus and Anterior Ethmoidal Cells. Reprinted from Annals of Surgery.

Braden Kyle. The Relation of the Nasal Chamber and Accessory Cavities and Dental Lesions. Journal of the American Medical Association, October 7, 1899.

Fillebrown. International Dental Journal, 1897.

Eugene S. Talbot. Journal of the American Medical Association, November 21, 1891.

Beaman Douglass. The Pneumatic Sinuses in the Sphenoidal Wings. Laryngoscope, 1901, vol. x. No. 2.

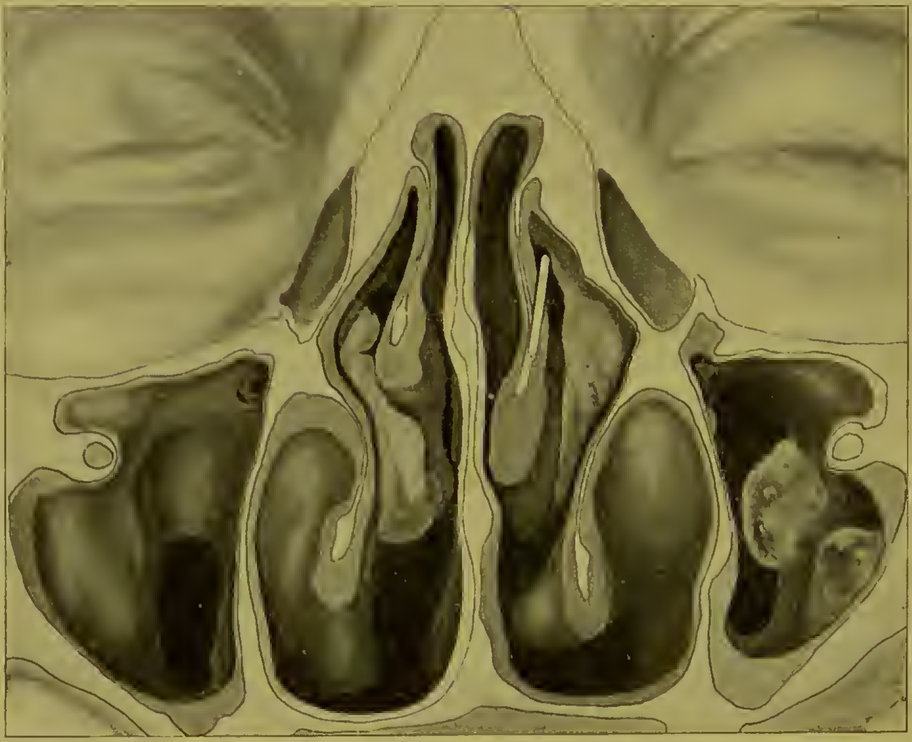
J. Mouret. Anatomie des Cellules Ethmoidales. Revue hebd. de Laryngologie, 1898, xix. 2, No. 31, p. 913.

A. Onodi. Des Rapports du Sinus Maxillaire avec le Sinus Sphenoidal et les Cellules Ethmoidales Anterieures. Revue hebd. de Laryngologie, Fév. 16, 1901, xxii 1, No. 7, p. 177.

M. H. Cryer. Studies of Some Facial Bones. Journal of the American Medical Association. Forty-eighth meeting, 1897, and Fiftieth meeting, 1899.

The maxillary sinus, or antrum of Highmore, has often been compared in shape to a three-sided pyramid. Some authors describe it as an inverted pyramid, the base being formed by the floor of the orbit and the apex situated over the roots of the molar teeth. Others place the base of the pyramid at the outer wall of the nasal chamber and the apex toward the malar process. In that case the three sides of the pyramid are formed by the facial, orbital, and zygomatic walls of the sinus. The temporal or posterior wall is formed by the body of the superior maxilla; it is concave and faces toward the zygomatic fossa. This is the thickest wall. The thin, orbital wall forms the roof of the sinus. The anterior wall corresponds to the facial surface of the superior maxilla and is always very much thinner over the canine fossa. Here it may only measure 2 mm. in thickness. The base of the pyramid corresponds to the outer wall of the nasal fossa, which is markedly convex toward the sinus. The anterior and posterior parts of the base are formed by the superior maxilla, and a reference to a dried skull will show how relatively stout they are. The central area of the base—formed chiefly by parts of the ethmoid—is very thin, and in certain points is closed only by membrane. The natural opening of the sinus which is found

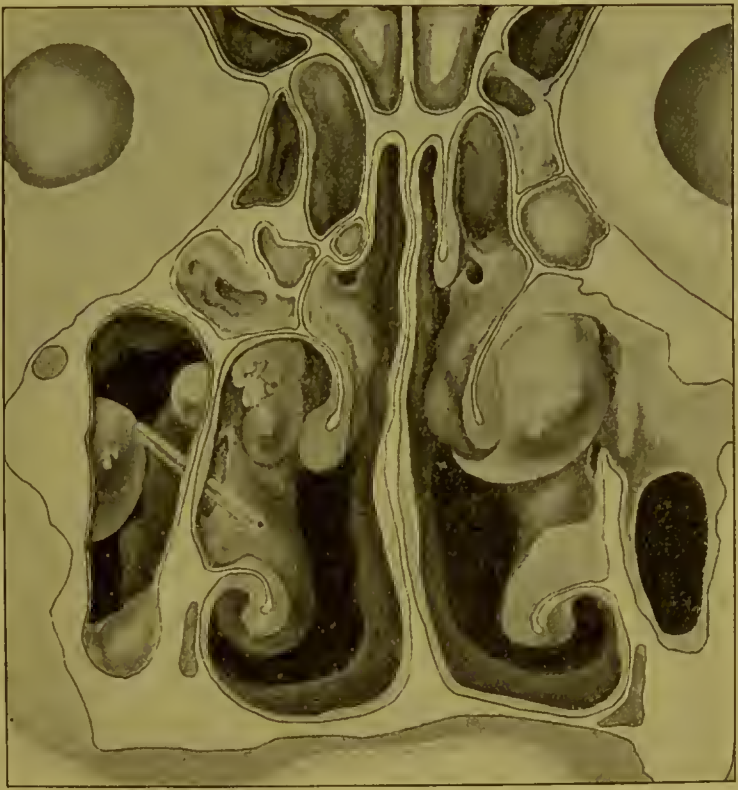
FIG. 480.



Coronal section in the anterior third of the nose, viewed from the front. Shows the inferior and middle turbinals; polypi growing from the ethmoidal region in each side; and polypoid degeneration of the lining of the left maxillary sinus. A probe is passed up into the frontal sinus on the left side. (Preparation by StClair Thomson.)

on this wall is much nearer to the roof than to the floor of the cavity. It opens into the middle meatus of the nose by the *ostium maxillare*, at the posterior extremity of the *hiatus semilunaris*. One or more accessory openings are sometimes met with, also in the middle meatus, generally posterior to the *ostium*. Above the level of the *ostium maxillare* the inner wall of the sinus comes into relation with the ethmoidal labyrinth. The junction of the anterior and posterior walls forms what is frequently referred to as the floor of the sinus. It is really a rounded angle. It lies above the alveolar border of the superior maxilla, and the roots of the teeth—particularly the second bicuspid and the first molar—are only separated from the cavity by a thin lamella of bone. The muco-periosteum is frequently arranged in folds or ridges, which form so many pouches, but it is very rare for the sinus to be divided into two cavities by a complete septum.

FIG. 481.



Coronal section about the centre of the nose, viewed from the back. The section shows the inferior, middle, and superior turbinals, and the maxillary, ethmoidal, and frontal sinuses. The relation of the ethmoidal cells to the frontal sinus, and of both to the orbit and cranium, are well seen. Polypi are seen in the middle meatus on each side, growing from the ethmoidal region; and there is polypoid degeneration of the mucous membrane of the maxillary sinus on the left side. A probe is passed through the left ostium maxillare. (Preparation by STCLAIR THOMSON.)

A large adult maxillary sinus will hold one ounce of fluid.[1] The average capacity is 14.4 c. cm.;[1] but of course much variation exists, owing to the numerous irregularities met with in the configuration of the sinus. The cavity may be represented by a narrow chink; more rarely it is entirely absent.[2]

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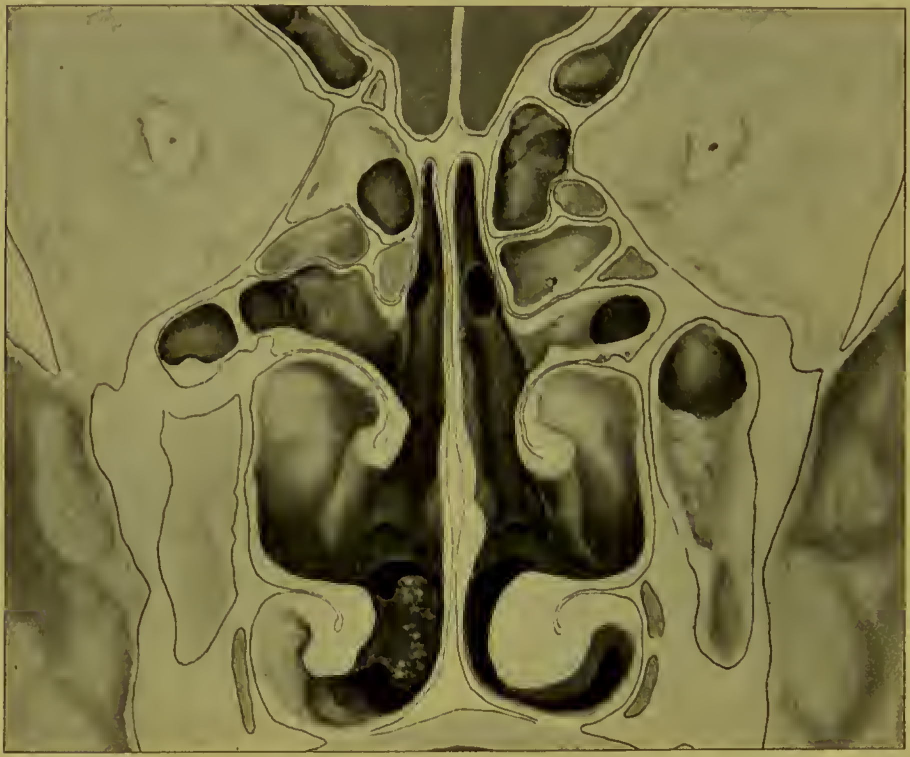
[1] W. A. N. Cattlin Transactions Odont. Society, London 1857, vol. xcix. p. 31.

Development. The maxillary cavity exists at birth, but in a rudimentary form. It reaches its full development about the age of twelve years.

The frontal sinus lies between the two lamellæ into which the frontal bone separates in the region of the superciliary ridge. As a rule the cavity is decidedly smaller in young people and in women than in men, but there is no necessary relation between a prominent superciliary ridge and a capacious frontal sinus, or the reverse (Zuckerkandl). But from an examination of 125 preparations Lothrop formed the opinion that "in general it is fair to conclude that the

FIG. 482.



Coronal section of the posterior third of the nose, viewed from the front. The section shows the inferior, middle, and superior turbinals. There is a polypoid, mulberry hypertrophy of the posterior end of the right inferior turbinal. A very small portion of the maxillary antrum is seen on each side. The relations of the frontal sinuses and ethmoidal cells to one another, and to the orbit and cranium, are well seen. The specimen shows the roof of the posterior choana, the front wall of the sphenoidal sinus, and the sphenoidal orifice on each side. (Specimen prepared by StClair Thomson.)

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[1] Braune und Clasen. Die Nebenhohlen d. menschl. Nase, etc. Zeitschrift f. Anat. u. Entwicklungsgesch, 1877, Band ii.

[2] Morgagni. De Sedibus et causis morborum, 1779.

more prominent the supra-orbital area, including the superciliary ridges and nasal eminence, the greater the probability of the presence of well-defined sinuses."[1]

The anterior wall is the thickest. It is about 5 to 6 mm. in thickness, but varies considerably in different skulls. It contains a good deal of diploic tissue, and this explains the flow of blood which may take place while opening it, and also the possibility of septic infection when the diploë are exposed. The posterior wall, supporting the anterior lobe of the brain, is thin and brittle. The floor of the cavity is irregular and often marked by the elevations of the fronto-ethmoidal cells. It overlies the roof of the nose and the orbit.

The cavity of the sinus extends upward on the forehead for a variable distance—sometimes for one and one-half inches or more. Backward it may reach so far that the entire roof of the orbit is divided by the frontal sinus into two plates. Outward it extends in the direction of the eyebrow, sometimes as far as the external angle of the orbit.

It is separated from its fellow on the other side by a septum. This is very irregular, and is so seldom in the mesial line that the two sides are often very irregular. Indeed, an opening made on one side of the middle line will sometimes expose the cavity on the opposite side of the body. The cavities are very irregular and unsymmetrical. They may be very small, or even entirely absent. Logan Turner found the sinus absent on both sides in 80 out of 500 museum skulls—(*i. e.*, in 16.1 per cent.),[2] but Sieur and Jacob examined 150 specimens without once failing to discover both cavities.[3] The sinus may be present only on one side. The sinus becomes funnel-shaped as it passes downward between the ethmoidal cells, to open into the middle meatus of the nose at the upper end of the hiatus semilunaris. It is noteworthy that the ostium of the frontal sinus lies at the most dependent part of the cavity. It is found at a short distance from the septum and further from the anterior wall than might be imagined. Tilley found that the infundibulum may lie as deep as 28 mm. from the anterior surface.[4] It leads into the frontonasal duct (1½ cm. long), which opens into the anterior end of the hiatus semilunaris.

The surface of the cavity is seldom smooth, recesses of various shapes and sizes being present. One long narrow pouch is apt to be met with running toward the outer extremity of the eyebrow.

The mucous membrane is thin and closely adherent to the periostium. It is scantily supplied with glands.

Development. The frontal sinus is absent at birth and during infancy. It is seldom evident before the seventh or eighth year.

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[1] Lothrop. The Anatomy and Surgery of the Frontal Sinus and Anterior Ethmoidal Cells, p. 18.

[2] British Medical Journal, October 14, 1899.

[3] Researches anatomiques, cliniques et operatoires sur les fosses nasales et leur sinus. Paris, J. Rueff, édit. 1901.

[4] Lancet, September 26, 1896.

With puberty it increases rapidly, and reaches its full size about the twentieth year.[1]

The ethmoidal cells deserve special consideration from the importance of their topographical relations, the frequency with which ethmoiditis is associated with pus-formation in other accessory cavities, and their irregular and complicated anatomical arrangements. The system of cavities in the ethmoid bone is lodged between the nasal cavity and the orbit. On the outer side it is closed in by a thin plate of bone which forms the greater portion of the inner wall of the orbit (*lamina papyracea* or *os planum*). (Fig. 481.) As a result of arrest of development (Zuckerkandl) and in old people, this plate may be defective in parts, and the separation from the orbit is then only maintained by membrane. On the inner side the ethmoid cells form a part of the outer wall of the nasal chamber, from which they are separated by a fragile lamella of bone. The superior and middle turbinals are in connection with this surface. A study of coronal and horizontal sections will show that the cells increase in size from before backward, and from above downward. They are divided into two groups, an anterior and a posterior. The anterior open into the upper part of the *hiatus semilunaris* by one or more openings, and therefore pour their secretion into the middle meatus. The ostia of the posterior group are situated above the middle turbinal, and therefore open into the superior meatus of the nose.

Development. As a rule, the ethmoidal labyrinth is not apparent in infant skulls, although Laurent states that the cells are visible in an eight months' fœtus.[2] It commences about the age of four or five years, and is not fully developed until about the twentieth year.

The sphenoidal sinus is an irregularly quadrilateral cavity situated in the body of the sphenoid bone, part of the anterior wall being formed by the ethmoid bone. The orifice of the cavity is situated in the thin anterior wall, a few millimetres below the roof of the nasal cavity, and therefore communicates with the superior meatus of the nose. The two sinuses frequently do not correspond in shape and size. One or both may be entirely absent. They are separated by a septum, which is seldom quite vertical, being bent to one or the other side. They are not often symmetrical.

The average capacity of the sinus is 6.67 c.cm. (C. R. Holmes).[3]

Development. The sphenoidal sinus is not present at birth. Its appearance is given by different authors at the third Steiner). seventh (Laurent), or twentieth year (Tillaux).

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[1] For further details on the anatomy of the frontal sinuses, *vide* Lothrop, loc. cit.

Tilley. Lancet, September 26, 1896.

Logan Turner. Edinburgh Medical Journal, April and May, 1896.

Redmond W. Payne. Anomalies of the Frontal Sinus. Journal of the American Medical Association, July 27, 1901.

Sieur. Note relative à l'anatomie des sinus frontaux. Revue hebd. de Laryngologie, 1901, xxii., M., No. 38, p 338. and literature on page 923.

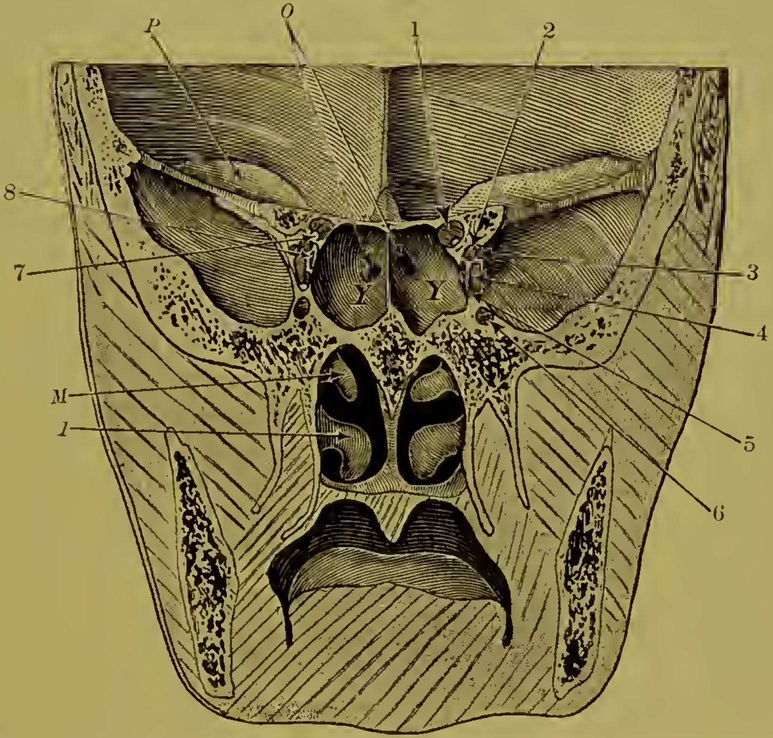
[2] Annales des mal. de l'oreille, 1899, xxv ii. p. 123.

[3] Archives of Ophthalmology, 1896, xxv. p. 460.

The Mucous Lining of the Accessory Sinuses. The accessory cavities are lined by a mucous membrane, which is so thin and so closely adherent to the periosteum that when a healthy cavity is opened in the living subject the bony walls are seen shining through with ivory-like whiteness and with all their outlines and ramifications clearly defined.

The mucous surface is coated with ciliated epithelium, which provides for the removal of secretion, and the importance of this function is realized, when we recollect the disadvantageous position for drainage of most of the ostia. The mucous membrane is considerably thinner than the nasal mucosa; the mucous glands are much scantier. Sappey,[1] indeed, only found them on the floor of the maxillary sinus. Zuckerkandl[2] says they are distributed on all the walls, but that they are neither so regular nor so numerous as in the mucous membrane of the nose.

Fig. 483.



Frozen section of anterior half of head, cut immediately in front of chiasma. Viewed from behind. *P.* Orbital roof of frontal sinus. *O.* Ostium sphenoidale. *Y Y.* Right and left sphenoidal cavities. *I M.* Inferior and middle turbinals. 1. Optic nerve with ophthalmic artery. 2. Third nerve. 3. Fourth nerve. 4. First division of fifth nerve. 5. Sixth nerve. 6. Second division of fifth nerve. 7. Ophthalmic artery. 8. Ophthalmic vein. (C. R. Holmes.)

Physiology of the Accessory Cavities. In the history of medicine various theories have had their day as to the function and purpose of the pneumatic chambers of the face. One ancient theory was that they served for the drainage of the brain, conveying the mucus and secretion of that organ into the nose—the "cloaca del cerebro" (Sansovino). Another view was that they served for the inspiration of air which went to the elaboration of the "animal spirits." At one time they were regarded as resonating spaces for the voice, while at another it was thought that they served for warming the inspired air. At times they have been regarded as serving for the secretion of mucus to lubricate the nose; as assisting in directing the inspired air toward the olfactory region; as accessory organs of smell; or as helping to diminish the weight of the bony cranium.

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[1] Traité d'anatomie, tome II. 2e partie, 2e fasc., p. 741.

[2] Anatomie normale et pathologique des fosses nasales, traduit en Français, 1895, tome i. p. 310.

That they can hardly contribute toward the secretion of mucus required for lubricating the nose is evident from the poverty of glands and vessels in their mucous membrane (Luschka), and from the position of their ostia.

That the hollowing out of the chambers would render the cranium less weighty appears at first a feasible suggestion; but if the cavities were replaced with spongy bone the difference in weight would be so slight as to be insignificant. A more plausible suggestion is that the hollowing out of the bones gives a wider attachment for the play of powerful muscles like the temporals.

Against the theory that they are connected with olfaction we may place the facts that no trace of the olfactory nerve can be found in them, and that not only animals with the poorest sense of smell have the best developed cavities, but certain apes and children—whom one has no reason to think are devoid of the olfactory sense—are practically wanting in sinuses.

The view that the sinuses help as resonating chambers for the voice has again come into favor lately.[1]

Etiology of Sinus Suppuration. The causes of sinusitis are not well-determined. They may be primary or secondary. By most writers the majority of cases are regarded as secondary to some intranasal affection. By others, such as Killian, they are considered to arise primarily in the majority of instances, and he appeals to E. Fraenkel's pathological researches[2] as supporting his views.

Undoubtedly many of the acute infectious diseases give rise to purulent inflammation in the accessory sinuses, the most common being influenza, pneumonia, enteritis, measles, scarlatina, smallpox, and cerebro-spinal meningitis. Diphtheria and erysipelas may also be mentioned, and among the rare causes are glanders, mumps, and gonorrhœa. It has been attributed to acute rheumatism, acute peritonitis, and also to contracted kidney. Mercurial ptyalism and phosphorus poisoning may cause suppuration in the maxillary and ethmoidal cavities. Plumbism has been found to be a causative agent.[3]

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[1] W. Xavier Sudduth. The Antrum of Highmore in its Relation to Vocal Resonance. Journal of American Medical Association, November 17, 1894.

[2] Virchow's Archiv, 1896, Band cxliii.

[3] Wagner. New York Medical Journal, August 15, 1896.

Among the secondary cases are those which are consequent on coryza, although many of these doubtless originate primarily and contemporaneously with the infection of the Schneiderian membrane. All processes in the nose associated with pus formation may induce empyema in the accessory cavities. The relation of ozæna, however, is still a vexed question.

There are numerous traumatic causes which are instrumental in conveying pyogenic matter to the sinuses or in diminishing the natural resistive power. As examples may be mentioned the use of probes and canulas, which may carry pyogenic organisms from a diseased to a healthy sinus, the employment of the galvanocautery, the misuse of the nasal douche, the adoption of nasal plugs, the presence of flies and larvæ, and even of vomited matter (Harke). Diving into water feet foremost is mentioned by Luc as a possible cause. Accidental intrusion of instruments and dressings will sometimes be responsible for the continuance of suppuration. Occasionally the mucous lining is extremely tolerant, as is shown by the case of Gérard-Marchant, in which a piece of forgotten drainage-tube remained in the antrum for twenty-five years. Portions of instruments, canulas, gauze, etc., may gain access to the cavity in the process of treatment, and Gouly, in relating a case,[1] recommends the adoption of forcible douching through an alveolar opening before having recourse to a larger opening. In this way he succeeded in driving the broken end of a canula into the nose through the *ostium maxillare.* Baratoux[2] extracted through an opening in the canine fossa one and one-half inches of laminaria tent, which had slipped into the antrum six years previously when being used to dilate an opening in the alveolar border. From another patient he extracted a mass of cotton-wool as large as a small orange. It appears that this material had been used by a dentist to stuff a hollow tooth; he did not realize that the carious cavity communicated with the antrum, and the disappearance of the daily plug of cotton-wool was thought to be due to the patient having lost or swallowed it.

External violence will sometimes set up a sinusitis—*e. g.*, blows over the frontal sinus—and when several sinuses are affected with chronic suppuration, operative interference on one cavity may, by obstructing the outflow of the others, produce in them acute symptoms.

The presence of nasal polypi occluding the natural ostia is often considered a cause of empyema; but the marked manner in which polypi cease to form when the diseased cavities are drained compels us to view them as usually the result rather than the cause of sinusitis.

A malignant growth, as well as tuberculosis and syphilis, will give rise to purulent processes in an accessory cavity.

Most of the chronic suppurations in the sinuses result from acute attacks, either from the intensity of the primary infection, or from secondary infections, or from local or general conditions unfavorable to resolution.

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[1] Archives Internat. de Laryngol., 1895, No. 1.

[2] Le Progrès Méd., Avril 6, 1895.

Bacteriology of Sinus Suppuration. This has been carefully studied by W. T. Howard, Jr., and J. M. Ingersoll, and summarized as follows:[1] Acute and chronic inflammation of the accessory sinuses of the nose are not caused by a single micro-organism, nor even by a single group of micro-organisms. It is, however, demonstrated that with a few exceptions (aspergilli and vermes), inflammations of the cavities are caused by bacteria. The bacteria found are those that are commonly present in the buccal and nasal cavities; in the former in health, and in the latter occasionally in health, and usually in disease, such as acute and chronic rhinitis (both atrophic and hypertrophic), nasal tumors, and the like. It is interesting to recognize that the common agents in the causation of inflammations of other parts of the air passages (the diplococcus lanceolatus, the pyogenic staphylococci and streptococci, the bacilli of the group of Friedlaender's bacillus [B. mucosus capsulatus], the B. diphtheriæ, and the B. influenzæ) are the most important and the usual micro-organisms found in inflammatory processes of these adjuncts to the respiratory system.

The relation of the infectious diseases, both local and general, to these inflammations is of great importance.

There are two groups of these cases: the first in which the accessory sinuses are invaded by a direct extension of the inflammatory process, as in acute and chronic rhinitis, coryza, influenza, diphtheria, pharyngitis, tonsillitis, tuberculosis, syphilis, nasal tumors, erysipelas, and injuries; and second, those cases in which parts of the body remote from the sinuses are primarily affected, as in erysipelas, articular rheumatism, pneumonia, phthisis, meningitis, and suppurations in general, or diseases in which the whole system is involved, as measles and scarlatina; in all of these the normal resistance of the sinuses is so lowered that bacteria which reach them from distant parts by means of the blood, or from neighboring parts by the spreading of inflammatory processes, set up inflammation.

Fraenkel is the first to suggest that inflammatory processes of distant parts of the body may be the sources from which micro-organisms may reach the accessory sinuses by means of the blood. Some of his cases strongly support this view.

Luc records the case of a medical student who was attacked with acute fronto-maxillary sinusitis after making a post-mortem on a case of pneumococcal meningitis. He had no dental caries. A cultivation of pus from his empyema showed a pure culture of the pneumococcus.[2] In the serosanguinolent nasal discharge of an acute sinusitis which did not go on to a chronic suppuration the pneumococcus has been found in abundance.[3] In the post-mortems of many acute infections Weichselbaum detected the diplococcus pneumoniæ in the diseased accessory cavities.[1]

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[1] American Journal of the Medical Sciences, May, 1898.

[2] Luc. Revue hebd. de Laryngol., July 15, 1899.

[3] R. Bernard. Ibid., 1898, xviii., 1, No. 33.

E. Fraenkel, Dmochowski, and others have found various organisms in empyemata; but their simple enumeration does not assist the question materially. More interesting are the researches of Stanculeanu and Baup, who found that the organisms of sinus suppuration might be divided into two groups: (1) Those of nasal origin, such usual organisms as pneumococci, streptococci, and staphylococci, were chiefly aërobic, and the pus was not fetid; (2) those of dental origin, such as bacillus ramosus, perfringens, thétoides, and staphylococcus parvulus, were mainly anaërobic, were found to be due to dental caries, and produced a fetid pus. In two cases the fetor was attributable in part to the bacterium coli.[2]

Morbid Anatomy. The changes in the mucous membrane are of a similar type in the various cavities, though in certain sinuses one particular form may be more marked and more frequently met with than in another. They are essentially of a chronic inflammatory character, and the changes in the tissues leading to a round-celled and serous infiltration are described elsewhere. Following on this there is polypoid and cystic degeneration, periostitis, rarefying osteitis, and caries.

In the maxillary sinus the mucous membrane is generally swollen, soft, and gelatinous. Cysts and hemorrhages are met with. In chronic cases cheesy pus is found in the villous and fungus-like processes of the degenerated mucous membrane. Carious spots may be met with, especially on the nasal wall, where they may lead to communications being established with the ethmoidal cells, and through them with the frontal sinus. Zuckerkandl, however, has never observed caries as a result of empyema.

In the ethmoidal labyrinth, on the other hand, osteophytes are very frequently encountered, and their pathology has given rise to much discussion since Woakes drew particular attention to them.[3] Granulating osteitis, carious destruction of bone, and polypus formation are all met with very frequently in purulent ethmoiditis.

In the frontal sinus suppuration appears to have a special tendency to produce grave secondary changes on its posterior wall.

In the sphenoidal sinus erosions and necrosis of its anterior wall may occur. Polypi are rare.

Acute Inflammation and Suppuration. **Etiology.** Acute inflammation of the cavities forms a part of many acute catarrhs of the nose, from which it may spread by direct extension. Or it may arise through the swelling of the nasal mucosa blocking the communication of the sinus with the nasal chamber. The confined air becomes absorbed, and a *hydrops ex vacuo* takes place. This, with a congested lining membrane, is a very suitable nidus anent the arrival of any infective organism. But acute infections may arise primarily in the sinuses, and originate from any of the causes already enumerated. Acute exacerbations are not uncommon in the course of chronic empyemata.

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[1] Wiener med. Wochenschrift, 1890, p. 223; 1893, pp. 32, 33.

[2] Archives Internat. de Laryngologie, 1900, xiii., No 3, p. 177.

[3] British Medical Journal, December 17, 1892.

Symptoms. The symptoms complained of are so frequently associated with acute nasal coryza that reference should be made to the chapter dealing with the subject. The occurrence of a rigor or rise of temperature would indicate more than a simple catarrh. The symptoms which chiefly point to the implication of a sinus during an acute "cold in the head" are (*a*) pain in the region of the cavity, generally described as neuralgia, and (*b*) tenderness on pressure. Lacrymation and photophobia may occur with acute inflammation in any sinus, although more common with affections of the frontal and ethmoidal. Facial neuralgia, œdema, slight congestion, and tenderness are most often met with in the maxillary and frontal sinus. A deep-seated, dull, heavy headache, with a sense of oppression between the eyes, is more often encountered when the sphenoidal sinus is involved. More than one cavity may of course be affected at the same time.

Relief is obtained by the discharge of mucus which forms part of the usual evolution of a cold. As it is impeded it frequently becomes purulent.

The discharge may be bloodstained, and an acutely purulent inflammation is often relieved by a free gush of pus, frequently very offensive both to smell and taste.

On examining the nose the usual evidence of acute rhinitis will be visible. If the anterior group of sinuses is affected, the middle turbinal will be particularly congested, infiltrated, and pushed against the septum, while the meatus below it will be clogged with stringy mucus, and later on with muco-pus or pus. This discharge may terminate the acute stage; but occasionally the flow lessens, and the symptoms recur until relieved by a fresh gush of matter.

When the posterior group is affected the rhinoscopic mirror will show a deeply congested and velvety appearance of the fornix and anterior sphenoidal wall, and muco-pus will ultimately be visible above the superior turbinal.

Transillumination, to be described later, is often of much service.

Treatment. The chief indications are to facilitate the escape of the pent-up mucus or pus and to soothe the pain. The principles of treatment are (1) rest in bed, (2) very warm, moist compresses on the forehead or affected cheek, (3) frequent inhalations of steam, medicated by the addition of a few drops of a 10 per cent. solution of menthol in alcohol, (4) antiseptic gargles, (5) anodynes, and (6) the careful use of warm nose lotions.

A spray of adrenalin may reduce the congested turbinals, and the same effect can be obtained by a spray of 2 per cent cocaine. If the maxillary sinus is affected any carious or suspicious teeth should at once be dealt with.

It has been recommended to attempt the expulsion of the contents of the cavity by the administration of a Politzer inflation of air. Such a proceeding is of doubtful efficacy, and even if it helped to empty one cavity it would risk scattering the expelled contents in the middle ear or elsewhere. A better plan would be that suggested by adopting the Toynbee method for emptying the middle ear of air—swallowing water while the nose is firmly held—so as to suck liquid secreted in the sinuses into the throat.

As soon as free secretion takes place from the nose it can be encouraged by the usual methods. The neuralgic pain is best relieved by keeping the patient warm in bed, with the head well wrapped up in flannel. A few doses of antipyrine, or other coal-tar analgesic, or a hypodermic of morphine, will best secure relief. The treatment otherwise is that of the accompanying coryza, and in the majority of cases is sufficient. If very urgent symptoms are present the anterior end of the middle turbinal should be removed and an attempt may be made to catheterize the affected cavity. An external opening should be reserved for extreme cases.

Chronic Suppuration in the Accessory Sinuses. This form is frequently referred to as an empyema, and has been described as "latent," in order to distinguish it from the acute type, which makes its presence known by the foudroyant symptoms, which indicated to surgeons of a former age the only form of empyema they recognized. The study and general recognition of the latent form dates from the year 1886, when attention was particularly directed to it by Ziem, although an early appreciation of sinus disease was manifested by Spencer Watson in 1875.[1]

A chronic empyema occurs much more frequently than was formerly thought to be the case, and its diagnosis and treatment call for much study and care, and this for the following reasons: (1) There is often some associated affection of the nose; (2) several sinuses may be affected at the same time; (3) the symptoms are frequently not characteristic; (4) direct evidence of the affection or of its localization can sometimes only be arrived at by indirect methods; (5) the etiology is not well established, and most of the cases take a common origin from the nasal cavity; (6) the prognosis has to be very carefully considered; (7) the indications of treatment vary considerably in different cases; hence (8) the importance of a complete diagnosis of all the sources of nasal suppuration; (9) the affection tends in certain cases, as yet not well-determined, to fatal sequelæ; finally (10) the treatment requires considerable study and skill, and is not devoid of danger.

Frequency of Suppuration in the Accessory Cavities. It is difficult to determine what proportion of patients are affected by empyema. Fein reports that among 2280 private patients of Chiari there were 45 cases of accessory sinus suppuration. Lichtwitz[1] encountered 243 cases among 12,000 patients.[2] Both these statistics coincide in giving an average of about 2 per cent. of the patients presenting themselves at a throat clinic.

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[1] W. Spencer Watson. Diseases of the Nose and its Accessory Cavities. London, H. K. Lewis, 1875.

From post-mortem observations we have several sets of statistics in regard to empyema:

Harke found	116 cases of sinusitis	in 400 cadavers.[3]
E. Fraenkel found	63 " "	in 146 cadavers.[3]
Lapelle and Martin found	70 " "	in 200 cadavers.[3]
Kiaer found	88 " "	in 195 cadavers.[4]

These figures give an average of over 30 per cent. of sinus disease in all subjects coming to the dead-house. The first idea suggested by them is that we must, in the living subject, overlook an immense number of cases; but a critical study of the above reports shows that many slight changes are recorded as sinus disease, and besides we have no means of judging how many cases originated only in the last fatal illness—often some infective affection. The conclusion is, however, doubtless justified that a fair number of cases do escape detection during life.

These post-mortem observations agree with the majority of clinical observations in showing that the maxillary sinus is the most commonly diseased. Killian is of the opinion that the affections of this sinus only—unilateral or bilateral—form one-half of all the cases we have to treat.[5] The distribution of Lichtwitz's 243 cases also showed that the antrum of Highmore headed the list. His figures give—

A single maxillary sinus	127 times.
Both " "	28 "
A single sphenoidal "	17 "
Both " "	31 "
A single frontal "	6 "
Both " "	9 "
Single ethmoid	1 "
Both "	2 "

In the remaining 22 cases the sinuses were more mixed, but the following were affected:

Maxillary sinus	13 times.
Sphenoidal "	15 "
Frontal "	10 "
Ethmoid	7 "
Pansinusitis	1 "

It will be noticed in these figures of Lichtwitz's that the sphenoidal sinus is, next to the maxillary, the most frequently diseased. This sequence is supported by Grünwald, who has opened 51 sphenoidal sinuses and has only found it necessary to do the external operation on 14 frontals.[6]

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[1] Wiener klin. Wochenschrift, 1898, No. 28, p. 701.

[2] Quoted by F. Martin. De la Fréquence de l'Empyème. Bordeaux, 1900.

[3] Quoted in Thèse of F. Martin.

[4] The Laryngoscope, 1899, vi., No. 2, p. 81.

[5] Heymann's Handbuch der Laryngologie, Wien, 1900, Band iii.

[6] Grünwald. Nasal Suppuration.

To show how different schools and observers vary on this point it is sufficient to quote Bosworth, who is of the opinion that true primary disease of the sphenoidal sinus is very rare. He had (in 1895) only seen two undoubted cases of it, to one hundred and fifty of ethmoid trouble,[1] which he regards as "by far the most frequent of all diseases of the accessory cavities."[2] In this he is supported by some recent statistics of John Mackie, who found 50 of his cases distributed as follows:[3]

Ethmoid	44 times.
Maxillary	11 "
Frontal	11 "
Sphenoidal	8 "

Evidently, from the divergence of these opinions, certain cavities when diseased are more apt to be diagnosed by some observers than by others, and therefore we may conclude that a fair number of cases still escape detection in everyone's practice.

Symptoms. An empyema in one of the accessory cavities of the nose is often only referred to by patients as a "chronic cold in the head." If inspection leads to the discovery of pus in the nose, especially if it is one-sided, the probability of an empyema is at once manifest, and the application of certain tests will render its presence certain. But in a large number of cases the symptoms may be more remote, and attention may only be directed incidentally, if at all, to nasal trouble. It is undoubted that a large number of cases are overlooked in practice in consequence of a want of knowledge of the numerous results which may follow on chronic suppuration in one of the pneumatic chambers. Although these sequelæ should, strictly speaking, be considered as complications of the affection, it appears more practical to consider them as symptoms, and in the first place to review such of them as may occur with pus in any cavity.

Symptoms Common to Empyema in any Accessory Cavity. Presumptive Evidence of an Empyema. The one constant cause of the symptoms is the presence of pus in one of the accessory cavities of the nose and its slow outflow into the nasal chambers. The symptoms this condition will produce may be grouped in three classes, as suggested by Lichtwitz:[4]

I. Symptoms in neighboring regions—the nasal chambers, pharynx, eyes, ears, head, and face.

II. Symptoms in more distant organs—lower respiratory tract, digestive tube, etc.

III. Symptoms of interference with general health—prostration, loss of weight, fever, etc.

I. **Symptoms in Neighboring Regions.** 1. NASAL SYMPTOMS. The two most usually complained of are (*a*) obstruction, and (*b*) discharge.

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[1] Transactions of the American Laryngological Association, Seventeenth Congress, 1895.

[2] Ibid., Sixteenth Congress, 1894, p. 146.

[3] British Medical Journal, September 28, 1901, and Journal of Laryngology, 1901.

[4] Annales des mal. de l'oreille, etc., 1896, tome xxii. p. 113.

The obstruction may be unilateral or bilateral. It varies according to the amount of excretion, the position of the head, the time of day, the general health, the weather, the cavities affected, and any recent increase of "catarrh." It is usually worse in ethmoidal affections, owing to the development of polypi. The discharge is more marked in the morning hours, owing to accumulation having taken place in the night; and also when the head is bent forward, and during cold or damp weather.

The discharge may flow forward when the front group of cavities are affected, or backward when the posterior are concerned. But there are exceptions to this, and the outflow may take place in both directions. It presents many varieties of muco-pus and pus, being yellow or green, fluid or drying into crusts, and it also varies in amount in the same way as does the obstruction.

Atrophy of the nasal mucosa occurs in so many instances that every case of atrophic rhinitis should be regarded as possibly being due to accessory sinus suppuration. Grünwald is even of opinion that it has not been established that ozæna represents a pathological entity, and, although many are not prepared to accept this view, it is undoubted that in proportion to the greater frequency with which sinus disease is now recognized in our clinics, cases of true fetid atrophic rhinitis have become proportionately diminished.

Hypertrophic rhinitis is less often met with, but is found in early stages. Sometimes the two conditions are present together.

Rhinitis caseosa is so frequently a symptom of sinusitis, chiefly of the antrum of Highmore, that Luc is of opinion that it does not exist as a separate pathological entity.[1]

Nasal polypi are so suggestive of disease in the accessory cavities that Grünwald has stated that "polypi in a majority of all cases are almost as good as pathognomonic of empyemata of the accessory cavities, or focal suppuration in the nasal passages."[2]

Disorders of smell and taste are often indicative of the disease. There may be parosmia or complete anosmia. More frequently the complaint is of an intolerable although intermittent cacosmia, always worse, as the patient puts it, "when the discharge comes away." This smell is seldom perceptible to the patient's entourage, and this helps to distinguish it from the smell of true ozæna which can be perceived at some distance, although undetected by the patient herself.

2. In Nasopharynx and Pharynx. Postnasal catarrh is sometimes the only symptom a patient will complain of.

Tornwaldt's disease, or bursitis pharyngea, is considered by Ziem to be merely a symptom of suppuration in the accessory chambers.[3]

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[1] Luc. Leçons sur les suppurations des l'oreille moyenne et des cavitiés accessoires des fosses nasales. Paris, Librairie J. B. Baillière et fils, 1900, p. 227.

[2] Grünwald. Nasal Suppuration. Translated by Lamb. London, 1900, p. 87.

[3] Ziem. Ueber retronasal Katarrh und sogenannte Tornwaldt'sche Krankheit. Therapeut. Monats., 1890, No. 4.

Ziem. Nochmals die sogennante Tornwaldt'sche Krankheit. Wiener klin. Wochenschrift, 1892, No. 6.

Inflammation, suppuration, and abscess in the pharyngeal and palatine tonsils, the pharynx, and the cellular tissues of the neck may be symptomatic of the descent of pus from the sinuses.

The Eyes. Many cases often present themselves in the first instance to the ophthalmologist, so much do the eye symptoms induced overshadow all others.[1]

The eye symptoms may be produced either directly (1) by obstruction of the lacrymal passage and consequent conjunctival affections; or (2) by inflammatory extension producing periostitis of the orbit, retro-ocular phlegmon, etc.; or (3) reflexly by inducing chronic conjunctival blepharitis, phlyctenular keratitis, diminution of the field of vision, asthenopia, scotomata, photophobia, dilatation of the pupil, blepharospasm, and ptosis. Iritis, cataract (Ziem), hemorrhagic retinitis (Kuhnt), and glaucoma have been observed. Atrophy of the optic nerve has been more frequently met with.

Ears. Tinnitus, vertigo, and other reflex symptoms may indicate an empyema, and the occurrence of Eustachian catarrh or purulent infection of the middle ear may first attract attention to it.

Cranium. The various forms of headache, hemicrania, and neuralgia may be symptomatic of sinus affection, and I am inclined to think that in adults nasal suppuration is only less frequent as a cause than errors of refraction. Intracranial suppuration, sometimes precipitated by acute attacks in latent cases of empyema, may be the first symptom, although of course it should be classed as a complication.

Cutaneous Affections of the Face. Eczema of the nostrils and upper lip, erythema, œdema fugax, abscesses of the face, and particularly attacks of facial erysipelas are among the more unusual symptoms of an empyema.

II. **Symptoms in More Remote Parts.** 3. THE LARYNX. Unexplained cough, repeated attacks of acute laryngitis and bronchitis, a subacute condition of laryngitis, or hypertrophic laryngitis always demand an examination for nasal suppuration. This is the more necessary if the condition of laryngitis sicca, or ozæna of the larynx, is met with.

Chronic bronchorrhœa, asthmatic attacks, and recurrent outbreaks of bronchopneumonia inducing many of the characters of pulmonary tuberculosis have in various cases been found to be symptomatic of absorption of nasal pus.

The Digestive Tract. The descent of pus into the stomach gives rise to various gastric disturbances, and may be the cause of obstinate vomiting and diarrhœa.

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[1] Simeon Snell. Distention of the Frontal Sinus, with cases. Quarterly Medical Journal, October, 1895.

Arnold H. Knapp. A Case of Extensive Chronic Empyema of the Frontal and Ethmoidal Sinuses, with Exophthalmos; Operation; Recovery. Archives of Ophthalmology, 1899, No. 1.

Charles Stedman Bull. Some Points on the Symptomatology, Pathology, and Treatment of the Sinuses Adjacent to the Orbit. Medical Record, July 15, 1899

J. H. Bryan. The Relation of the Accessory Cavities to Diseases of the Eye. Journal of the American Medical Association, November 11, 1899.

Vascular System. Phlebitis and bradycardia have been found associated with the affection under consideration.

III. **General Affections.** Among the conditions which have in some instances been traced to a sinus empyema are those of general ill health, loss of weight, and feverish attacks simulating typhoid or malaria, with or without septicæmic metastases. Insomnia or, on the other hand, marked somnolence during the day have been traced to this cause. Various cerebral conditions are not infrequently traceable to it, such as irritability, loss of memory, languor, weariness, stupor, aprosexia, neurasthenia, melancholia, and weakened resistance to the action of alcohol and tobacco.[1] At the meeting of the American Laryngological Association in 1894, Bosworth related the case of a patient who was restored to health by treatment for ethmoiditis after ten years of suffering from aprosexia and melancholia so profound that he had meditated suicide. The case is interesting from the long list of medical and surgical measures which had previously been resorted to without effect.[2]

Intracranial Complications. Most of the complications which may follow on suppuration in the sinuses have already been referred to in considering them as symptoms of the unrecognized condition. It is sufficient here to direct attention to the most serious of all the possible sequelæ of nasal suppuration, viz.: intracranial complications. These may arise secondarily to suppuration in any cavity, although with a simple case of maxillary sinusitis it is a comparatively rare contingency.[3]

Extension to the base of the skull has been demonstrated in many instances, and possibly takes place more frequently than is suspected. These serious complications occur in both acute and chronic affections. They may arise (1) by infection of the diploë; (2) by infection through the venous or (3) lymph channels of the bone, without any palpable trace of the route of infection; (4) by caries and destruction of the sinus wall, so as to allow of the pus coming into direct communication with the meninges; and (5) by mischief-spreading along the ophthalmic vein to the cavernous sinus.

When the bone becomes infected it may give rise to a slow and apparently irresistible septic osteomyelitis of the cranium. If the infection traverses the bone, leaving the latter intact, the result may be a cerebral abscess, or thrombosis of the superior longitudinal, cavernous, or petrosal sinus. When the dura mater is exposed the result is an extradural or cerebral abscess, or a purulent basal or general meningitis. Any combination of these complications may be met with.

Until the accessory sinuses are examined systematically in post-mortems on all cerebral cases, the true source of many infections must escape detection. Those which have been revealed have generally had attention directed to them by some antecedent nasal operation. It is not fair to at once attribute the fatal result to surgical interference, for cases have been recorded in which some other coincident latent affection has been the true cause. Still the fatal issue in some cases has been apparently precipitated by surgical treatment which has interfered with drainage from other sinuses whose diseased condition had possibly not been suspected. These considerations explain the importance which has already been laid on making a complete diagnosis, if possible, before initiating any radical measures, and of following a certain sequence in treating mixed cases. It is hardly necessary, in addition, to emphasize the importance of strict asepsis on the part of the surgeon so as to avoid the importation of any fresh infective material, the avoidance of nasal or other plugs which might interfere with free drainage, and the prompt recognition and treatment of any of these complications.

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[1] Walter A. Wells. Some Nervous and Mental Manifestations Occurring in Connection with Nasal Disease. American Journal of the Medical Sciences, December, 1898.

[2] New York Medical Journal, October 12, 1895.

[3] R. Dreyfus. Die Krankheiten des Gehirns und seiner Adnexa im Folge von Naseneiterungen. G. Fischer, Jena, 1896.

Treatment. It is only possible here to refer to the importance of at once relieving all tension in any suspected case, and, where necessary, of opening the cranial cavity. With spreading meningitis little is to be expected, and septic osteomyelitis appears to be a particularly malignant form,[1] but in other cases it may still be possible to save life.

Prognosis. The majority of primary acute cases tend to complete resolution, although the progress may be irregular and the attack last for a few days to, with relapses, a few weeks.

It is the acute attack supervening on a chronic affection which proves most intractable. These very acute cases are less frequently met with than formerly. Still, if unrelieved, the acute suppuration may lead to acute distention of the affected cavity, which may ultimately rupture. Thus an acute maxillary sinus abscess may burst through the cheek below the orbit, the canine fossa, an empty tooth socket, or even through the hard palate. An acute collection of pus in the frontal sinus may point anteriorly beneath the inner part of the upper eyelid; or it may rupture into the cranial cavity; or by infecting the veins of the diploë give rise to spreading septic osteitis —osteomyelitis. The roof of the sphenoidal sinus is not likely to yield in a recent acute attack. Retention of an acute formation of pus in ethmoidal cells may also burst into the orbit or the cranium, but from their anatomical connection these cavities are more likely to empty into the nasal fossæ.

When more or less complete obstruction leads to threatening symptoms the dominant one of pain generally points in good time to the necessity of intervention, and secures its acceptance before dangerous complications arise.

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[1] Luc. Journal of Laryngology, September, 1899. Tilly. Ibid.

In the chronic forms there is little tendency to spontaneous recovery. Jonathan Wright has expressed the opinion that many cases must tend in time to natural recovery. This view is unsupported by clinical records, and most observers are forced to the conclusion that an established empyema shows no disposition to disappear, but, on the contrary, tends in time to infect other accessory cavities. Slow and insidious changes in the diseased cavities are often only revealed by the sudden development of grave intracranial complications.

Temporary alleviation is very common, and the symptoms in some cases will almost entirely disappear during fine weather and when the patient is in good health. Such improvements are often attributed to climate, and are apt to be deceptive.

The dangers to health vary very much in different cases; in some a lifelong "catarrh" causes little more than a trifling local inconvenience. In others existence is rendered almost intolerable by a suppurating focus.

The dangers to life are said to be rare when we remember the small proportion of fatal cases to the frequency of the disease. The prognosis will depend on many general considerations, such as the patient's age, temperament, general health, and occupation, as well as on the cavity or cavities affected, the indications of secondary changes, etc. In all cases a guarded prognosis should be given as regards duration of treatment and completeness of cure. Final diagnosis is often only possible during a course of treatment, as after one cavity has been dealt with it is found that another calls for investigation. In many cases, while decided improvement can be promised, the necessity for continuous treatment should not be denied, and a certain amount of mucopurulent discharge may have to be tolerated.

Chronic Suppuration of the Maxillary Sinus. *Synonyms:* Empyema of the antrum of Highmore; maxillary sinusitis.

Symptoms. Chronic suppuration in this cavity may follow on an acute attack, or may develop as a "latent" affection. When any of the presumptive symptoms of an empyema are present the discovery of decayed teeth should attract attention to the antrum. Even when the teeth appear sound, careful examination by percussion and transillumination may reveal a root affection. It has lately been suggested that if the tuning-fork is applied over the upper teeth it will not be heard by the patient as distinctly on a diseased as on a healthy side.[1]

If the secretion of pus is so slight that it only occasionally overflows into the nasal chamber the objective symptoms are proportionately slight, and the diagnosis the more difficult. In such cases the patient may complain chiefly, or only, of a haunting cacosmia. Faceache or neuralgia may be the only complaint. The pain or tenderness is generally over the facial surface of the superior maxilla; but it may be referred entirely to the frontal region. It frequently presents a certain periodicity, increasing for some hours after rising in the morning, and then disappearing as the day goes on. This is explained by the accumulation of the night escaping from the cavity during the early working hours. A colleague who had lived in the tropics had diagnosed his own case as one of "brow ague," and was unconvinced of the correct diagnosis until a fearfully foul collection of pus was expelled from his maxillary sinus.

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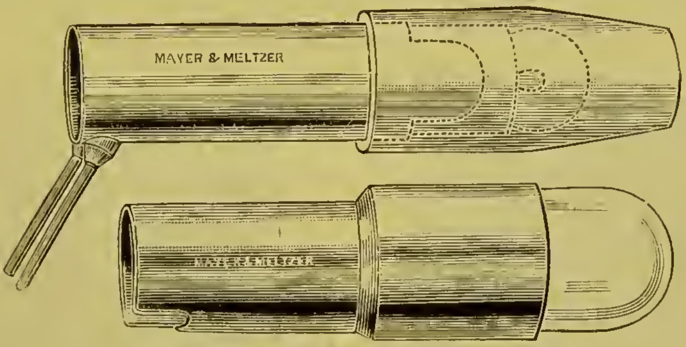
[1] D. A. Kuyk. Laryngoscope, 1901, x., No. 2, p. 106.

When the outflow of pus into the nose is more decided and continuous, other symptoms are added to those already described. Sometimes the secretion passes so rapidly backward that it may be readily overlooked, or mistaken for postnasal catarrh, or an affection of the posterior group of sinuses.[1] In doubtful cases the patient should always be examined in the morning hours, as after midday the sinus has often become so emptied that no pus overflows into the nose during the rest of the day.

FIG. 484.



Transilluminating lamp. The lower figure shows the removable glass cap. The upper figure shows the vulcanite cap as used with the frontal sinus.

Inspection of the nostril on the affected side will generally reveal pus in the middle meatus. It may have accumulated in the lower meatus, or by capillary attraction may have travelled up between the middle turbinal and the septum into the olfactory cleft. It is seen in the posterior choana lying below the end of the middle turbinal. The origin of the pus can be partially determined by carefully wiping away every trace of it from the nasal cavity. If done with pledgets of cotton, moistened with a 10 per cent. solution of cocaine, the inspection is more complete. The detection of a swelling between the concavity of the middle turbinal and the outer nasal wall—so-called "cleavage of the middle turbinal," or Kaufmann's swelling—has been considered as indicative of an empyema; but it is found with pus from the frontal sinus, and has been seen when no empyema was discoverable. It appears to be due to inflammatory thickening over the *processus uncinatus*—the lower lip of the hiatus semilunaris—and might be induced by any irritation.

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[1] Brady. Journal of Laryngology, November, 1899, xiv. p. 664.

After waiting a few minutes the nose should again be inspected, and if pus has reappeared in the middle meatus it would raise the suspicion that its origin was from the frontal sinus or anterior ethmoidal cells.

Posture Test. Supposing the pus does not speedily make its reappearance, the patient should lay the head well forward between his knees, with the affected side uppermost. This test (known as Fraenkel's) brings the ostium maxillare into the most dependent point of the sinus, and so facilitates the outflow of any liquid contents. When the head is raised and the nose again inspected, a stream of pus will be found in the middle meatus. Although, in the absence of other symptoms, these points may indicate the maxillary sinus as the source of the pus, we must proceed with our examination before we can speak positively. Polypi and granulations in the middle meatus are often stated to be suggestive of antral disease; but in uncomplicated cases they are rarely met with, and their presence generally points to infection of the neighboring ethmoidal cells.

FIG. 485.

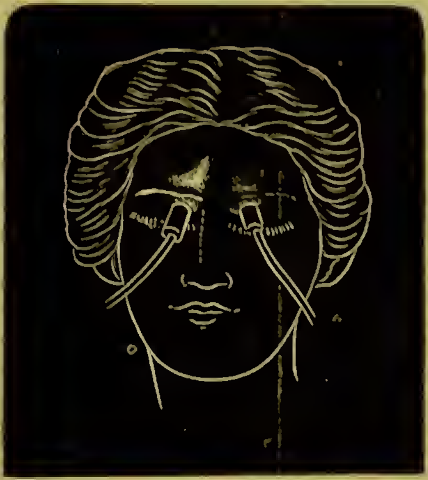


FIG. 486.

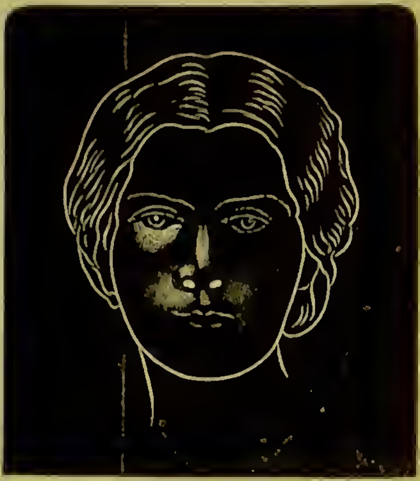


FIG. 485.—Transillumination of the frontal sinus. Shows how the sinus on the right side is lit up, while the left remains obscure. (STCLAIR THOMSON.)

FIG. 486.—Transillumination of the maxillary sinus. Shows on the right side how the cheek is lit up, a semilunar band of light appears below the eye, and the pupil is illuminated. On the left side these results are absent. (STCLAIR THOMSON.)

The test of transillumination, chiefly developed by Heryng, will sometimes afford strong confirmatory evidence. It is applied in the following way: It requires a small 5-candle electric 10-volt globe, of about 1 ampère current, encased in a glass cover which can be detached and disinfected. (Figs. 485 and 486.) The examination must take place in a completely darkened chamber, or else the heads of both patient and physician should be enveloped in a thick black cloth, such as that used by photographers. Any denture present having been removed, the lamp is introduced into the centre of the patient's mouth, and the current switched on. In normal conditions the rays of light pass upward and outward unopposed through the hollow cavities of the face, producing the following results:

1. A diffused glow of light over the lower part of the cheek and between the separated jaws.

2. A semilunar patch of light immediately below the lower eyelid, caused by the passage of the light-rays through the anterior part of the orbital wall of the sinus.

3. A subjective sensation of light by the patient, as the current is switched on, sometimes more marked when the eyes are kept closed.

4. Illumination of the pupil by the rays penetrating the sclerotic, so that the centre of the eye is lit up and glows like an animal's in the dark. In a healthy subject all of these may be present, but some are of more frequent occurrence and of greater value than others. Thus the third and fourth points are frequently wanting, and the second is the most valuable, and should be most carefully looked for.

When pus is present in the antrum of Highmore the passage of the rays is so obstructed that all these phenomena are diminished or abrogated. This transillumination test renders more service if only the sinus on one side is suspected, when positive results are easily contrasted with the opposite side, and would lend strong confirmatory support. On the other hand a negative result would tend to indicate that the pus seen in the middle meatus came, not from the maxillary, but from the frontal sinus. Transillumination may give positive results in the absence of an empyema, owing to—

1. Small size or complete absence of sinus.
2. Abnormal thickness of bony tissue.
3. Permanent thickening and opacity sometimes remaining in the lining of the cavity after complete cure of suppuration.
4. Presence of a malignant or other neoplasm.

Transillumination may give negative evidence, although the antral cavity is diseased, owing to—

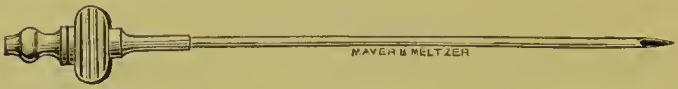
1. The cavity happening to be more or less empty at the time of examination.
2. The bones being particularly thin and translucent.

The test must not, therefore, be too much relied on. If positive, it may arouse a suspicion or confirm other symptoms. If negative, it may point to other cavities as the source of the pus, or may only indicate the necessity of seeking for other signs.

The only conclusive evidence of a maxillary sinusitis is the expulsion of pus from the cavity. This is done by exploring the cavity from (1) its nasal wall; (2) the alveolar border; or (3) from the canine fossa.

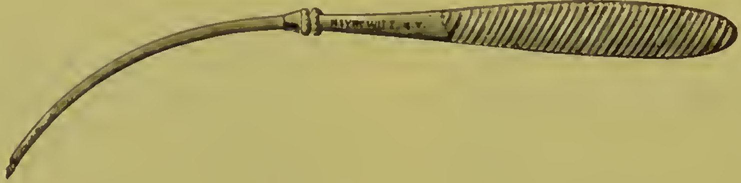
Exploratory Puncture of the Antrum. This can be carried out under adrenalin and cocaine. A good-sized pledget of cotton soaked with a 10 per cent. solution of cocaine is tucked well under the inferior turbinal, so as to anæsthetize the outer wall of the inferior meatus. The anterior part of the septum should also be anæsthetized, as the hilt of the needle may press painfully against it. A stout hollow needle, either straight (Lichtwitz) or curved at the extremity (Schmidt, Myles), is guided high up under the concavity of the inferior turbinal. It is then pressed against the antral wall at a point which is judged to be about the junction of the middle and posterior thirds a point much further back than is generally supposed. The patient's head being steadied with the left hand, the needle is pushed gently in a line directed toward the outer angle of the orbit. The shaft of the needle is grasped about half an inch outside the nares, in order to prevent it plunging too far into the sinus, and so traversing the cavity and penetrating the orbit. The point of the needle being felt free in the sinus, a Eustachian catheter bag is now attached and air pumped through the cavity. If the nasal cavity is kept under observation, pus and air bubbles will be seen making their exit from the region of the ostium maxillare, while frequently the foul odor of the secretion will be only too perceptible. This is followed by syringing a tepid solution of sterile normal saline fluid or of boric lotion through the hollow needle. This should be propelled with some force, as the secretion may be very inspissated, the cavity very tortuous, or the natural opening obstructed.

FIG. 487



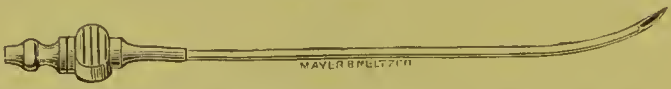
Hollow needle for exploratory puncture of the maxillary sinus.

FIG. 488.



Myles' trocar and canula.

FIG. 489.



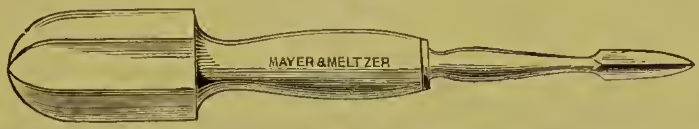
Curved hollow needle for exploratory puncture of the maxillary sinus.

The pus expelled is generally fetid and frequently flocculent. A small amount, or even a decided turbidity, of the lotion is sufficient to settle the diagnosis of empyema. When the lotion comes away clear the Eustachian bag should again be connected with the exploring needle, and air freely insufflated to expel any remaining liquid.

Should these proceedings fail to reveal a collection of pus a small quantity of a 20 per cent. solution of 10 vol. hydrogen peroxide is introduced into the sinus, when the effervescence with any pus will bubble out into the meatus.

Exploration of the Antrum from a Tooth Socket. If, on the suspected side, we find a carious bicuspid or first molar, or if the tooth sockets are empty, we can not only explore the cavity from the alveolar border, but at the same time initiate the treatment by drainage. If necessary the carious tooth can be removed under the same anæsthesia, preferably that of nitrous oxide gas. A large-sized hand-drill is employed. (Fig. 490.) Some prefer to employ a dental engine or an electromotor; but they are unnecessary, less under control, and less certain than an instrument guided by the hand. The point of the drill is directed vertically to the alveolus and in a plane with the centre of the patient's eye. Firm pressure, with a few rotatory movements, is sufficient to quickly perforate the floor of the antrum. The drill is prevented from plunging in too far by the operator's thumb fixed about half an inch from the margin.

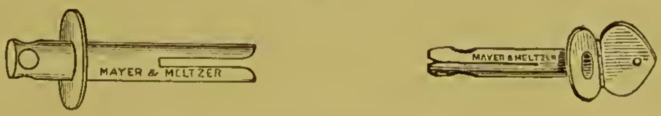
FIG. 490.



Ackland's hand-drill for opening the maxillary sinus from a tooth socket.

A preliminary inspection will help to assure the success of this operation. Thus, if the facial surface of the superior maxilla is very flattened, the hard palate arched, and the nasal chamber on the same side wider than usual, greater care must be taken in seeing that the drill does not miss the antrum by passing (*a*) outward beneath the cheek; (*b*) inward through the floor of the nose, or even (*c*) into the roof of the mouth. It is rare for this simple operation to be attended with a serious hemorrhage.[1]

FIG. 491.



Maxillary sinus drainage-tubes.

As the drill is withdrawn the escape of pus will often confirm the diagnosis. When the patient has recovered from the anæsthesia, the lotion and air should be sent through the cavity, as already described, and a permanent drainage-tube should be inserted. If the result of the exploration is negative, no harm is done, and if the opening is left alone it will close up in twenty-four hours.

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[1] Scheppegrell. Journal of Laryngology, 1895, ix., No. 9, p. 621.

Exploration through the Canine Fossa. This route is unsatisfactory, as it is more painful and not well suited for establishing treatment. It need only be adopted when no tooth socket is available, when attempts to explore the antrum from the nose have failed, and when the diagnosis cannot otherwise be fully established. It can be carried out under nitrous oxide gas, as local anæsthesia is not sufficient. A small incision is made down to the bone just above the prominence of the canine fang; with a raspatory the muco-periosteum is turned up and down, and a drill is employed as for the alveolar opening, but directed vertically to the surface of the canine fossa. The exploration of the contents is carried out as already directed.

Diagnosis. Cases have been reported of maxillary sinusitis in children.[1] This is surprising when we bear in mind the rudimentary condition of the cavity in early life, and it may be suggested that the above cases were instances of acute osteomyelitis of the superior maxilla—an affection described by several authors[2]—or of tuberculosis.

Obstructed cases have more than once been mistaken for malignant disease of the antrum; and on the other hand, the association of suppuration with such growths has led to the nature of the case being overlooked. The age of the patient, exploratory puncture, and careful examination both of the canine and nasal walls will generally prevent any error in diagnosis.

Acute suppuration in the sinus might be mistaken for dental periostitis. The latter is an external affection, whose progress can be watched. The tests given will show the freedom of the antral cavity.[3]

Treatment. In all cases attention to the teeth should precede all other treatment. Treatment of a maxillary sinusitis can be carried out (1) through the natural orifice, or (2) through the nasal, (3) the alveolar, or (4) the facial surfaces of the cavity.

1. *Through the Natural Orifice.* Daily irrigation of the cavity by this route has been recommended by a few rhinologists.[4] Garel has succeeded in irrigating twenty-eight out of forty-four antra through the natural orifice.[5] (Fig. 492.) It is not usually easy to catheterize the ostium maxillare, and the manipulation is generally facilitated by removing part of the middle turbinal.

2. Cases have been recorded in which a single exploration from the inferior meatus has been followed by apparently permanent cessation of suppuration. It is, therefore, wise to always defer

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[1] D'Arcy Power. British Medical Journal, September 25, 1897. Alex. Douglas. Ibid., February 5, 1898. Emil Mayer. Transactions of the American Laryngological Association, 1901.

[2] Schmiegelow. Archiv f. Laryngologie, 1896, Band v. p. 125. Ropke. Münchener med. Wochenschrift, January 25, 1898. Lichtwitz. Société de Laryngol. de Paris, 1897. A. Castex. Bulletin de Laryng., 1901, iv. p. 171.

[3] G. Avellis. Revue hebd. de Laryng., 1899, No. 2, p. 48.

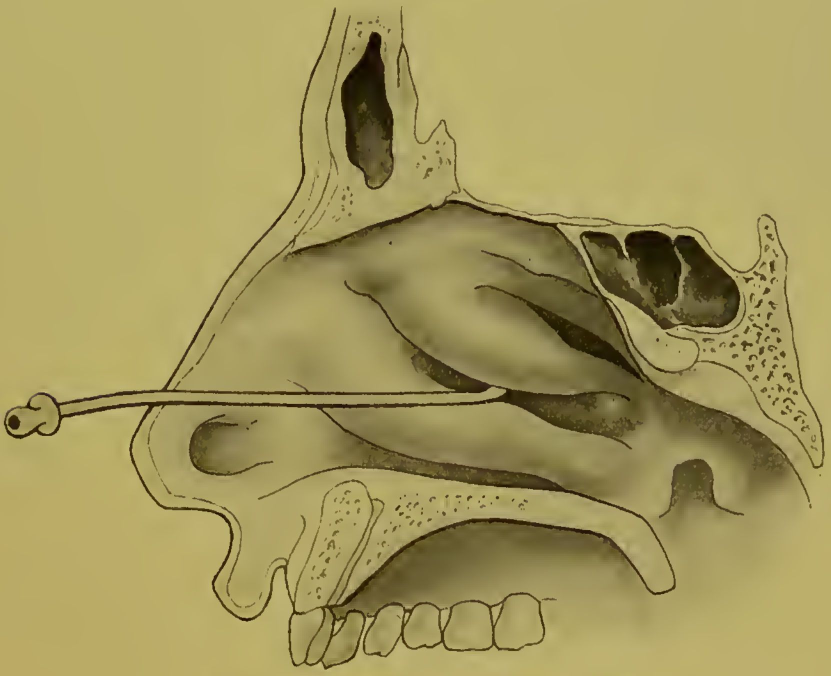
[4] Garel. Journal of Laryngology, August, 1894, viii. p. 530.

[5] Norval B. Pierce. Laryngoscope, September, 1901, xi. p. 197.

further treatment after an exploratory lavage, until pus is again evident in the nasal chamber. The success of a single treatment is perhaps due to the fact that the case was really a recent one undergoing spontaneous cure. Such cases in elderly people should be viewed with suspicion, as they are sometimes found to be owing to suppuration in connection with a malignant growth.

3. *Through the Nasal Wall.* It has been proposed by Mikulicz and Krause to make a larger opening, well forward (Walter Freeman),[1] under cover of the inferior turbinal with a large trocar and canula (Fig. 492), so that syringing and other treatment can be carried out from the inferior meatus. The method may be employed in patients who have an intact set of upper teeth on the side affected and who decline more arduous treatment. It is adequate for simple recent cases, but does not allow of the removal of pathological products in the lining membrane. The opening also tends to close, and is sometimes difficult to find hidden under the turbinal. Access to it, however, is facilitated by removal of the anterior end of the latter.

FIG. 492.



Method of catheterizing the maxillary sinus.

4. *Through the Alveolar Border.* The method of gaining access to the maxillary sinus from the alveolar border dates from the time of Cowper, in 1707. The manner of drilling the opening has already been described. It is generally recommended to introduce a drainage-tube fitted with a stud which can be inserted during meals. The

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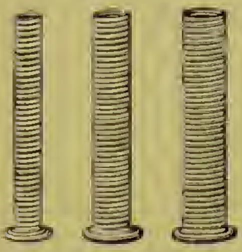
[1] Journal of the American Medical Association, November 30, 1895.

amount of drainage through such an opening is so slight that it is better to depend only on syringing, and to ensure as far as possible the separation of contamination from the mouth by introducing a solid stem obturator. This can be fitted on a denture. In hospital practice portions of Ellis' spiral wire are cut in suitable lengths.

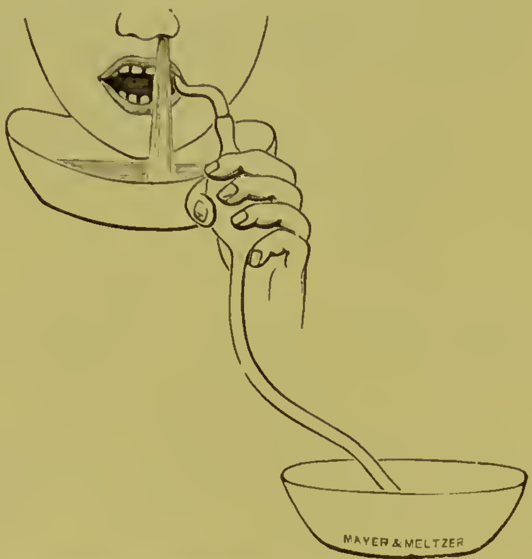
The obturator or drain is removed and the cavity washed out with a Higginson syringe. A pint of tepid sterile fluid should be employed each time, and the medicament used with it does not appear in most cases to be of great importance. Normal saline solution is generally satisfactory, and in cases of fetor we may add permanganate of potash, listerine, sanitas, phenosalyl, euthymol, or one of the unirritating compound antiseptics. At first the washing-out should take place morning and evening, the obturator being thoroughly cleansed and replaced immediately afterward. If this is neglected, granulations may spring up within an hour or so, impeding the replacement. When the liquid escapes from the nose in a clear stream the washings are diminished to once a day, then to every other day, and so gradually to once a week. When the cavity on several occasions is found to be free from secretion after remaining uncleansed for a week, we may consider the case cured and allow the alveolar opening to close—which it does spontaneously on discontinuing the drain or obturator.

FIG. 493.



Ellis' wire tubes for draining the maxillary sinus from the alveolar border.

FIG. 494.



Method of washing out the maxillary sinus from the alveolar border.

If the secretion persists we may try the use of stronger antiseptics or astringents—biniodide of mercury, chinosol, protargol, sulphate of zinc, etc.—before resorting to more radical measures.

Results. My own experience is that, as a rule, cases which are going to yield to this method show signs of doing so early—within a few weeks; while those which show no amelioration within three months are generally inveterate. A history of long-standing suppuration is not necessarily opposed to this. Cases of seven years' duration have been permanently healed with three months' syringing.[1]

When there is no suitable unsound tooth or empty socket in the upper jaw of the affected side it is not justifiable to sacrifice a sound tooth to initiate a method of treatment which is uncertain in its results. Hence in all cases of maxillary sinusitis with a sound set of teeth, and in those which have proved intractable to the methods of treatment already described, treatment must be carried out by opening the canine fossa and performing what is frequently referred to as the Caldwell-Luc operation.

5. *The Canine Fossa Operation.* Although originally designed by Caldwell, of New York,[2] in 1893, this operation was independently imagined and described in 1897 by Luc,[3] who has since given considerable attention to the subject,[4] his studies being embodied in a recent publication. There are two principles involved in the execution of this operation: (*a*) The first is the securing of such access to the maxillary antrum by a free opening in the canine fossa that the cavity can be carefully examined and its contents thoroughly dealt with. (*b*) The second principle is the establishment of free drainage from the antrum into the nose, on a level with the floor of the cavity. It will be at once seen that the realization of these two principles places this operation at a great advantage in comparison with any other method of treatment. In those which have been already described drainage is either inadequate or takes place into the mouth (whence reinfection readily takes place), while the physician is entirely in the dark as to the exact pathological condition of the diseased cavity, and therefore in ignorance as to what prospect of success his milder methods of treatment may secure.

The operation through the canine fossa requires a general anæsthetic. The patient should have the usual preparations made, and it is desirable to have the teeth put into good order and the mouth rendered as aseptic as possible. The nasal chamber of the same side should previously be cleared of any polypi which may be present.

The patient having been anæsthetized the lip and cheek of the affected sides are retracted so as to show the canine fossa. A mouth-sponge introduced between the molars on the side affected will be found useful in absorbing blood, which might otherwise trickle backward into the throat. An incision is then made at a distance of a few millimetres below the gingivo-labial furrow, and extending from the level of the first molar tooth forward to the canine prominence. (Fig. 495.) This incision passes at once straight down to the bone,

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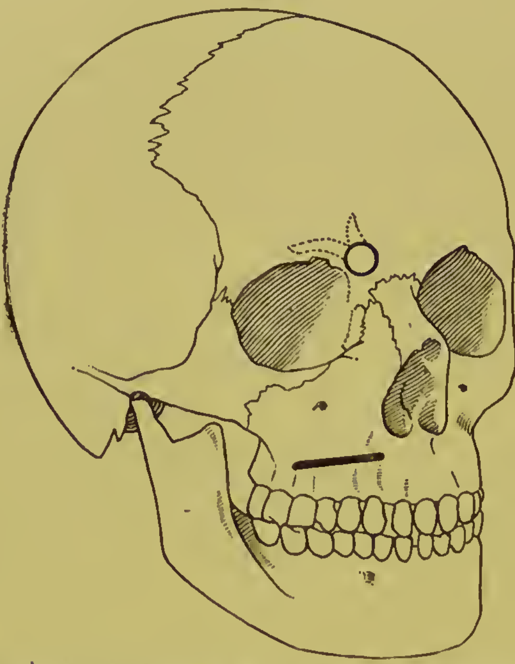
[1] StClair Thomson. Transactions of the Clinical Society. London, May 12, 1899.

[2] New York Medical Journal, November 4, 1893. The making of a double opening through both the canine and the nasal walls of the antrum was designed by Scanes Spicer in 1894. British Medical Journal, December 15.

[3] Société Française d'Otologie, etc., Mai, 1897.

[4] Leçons sur les suppurations de l'oreille moyenne et des cavities accessoires des fosses nasales. Paris, 1900.

FIG. 495.

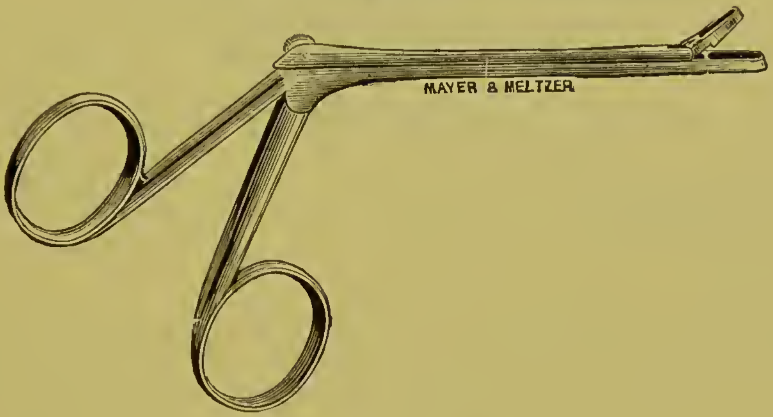


Opening the frontal and maxillary sinuses. Shows the point on the skull for exposing the frontal sinus; the dotted outlines indicate the directions in which the opening may have to be extended. Over the maxillary sinus the dark line marks the situation and extent of the incision through the gingivo-labial fold.

which is rapidly displayed by reflecting the muco-periosteum with a raspatory or periosteum detacher. With the chisel and mallet the canine fossa is broken down, and the entry into the sinus is often signified by the escape of pus and sometimes of a foul, penetrating odor. In many cases profuse bleeding takes place as the cavity is entered, but generally ceases as the opening is enlarged, so that a small sponge or plug of gauze can be inserted. The sponge placed between the patient's back teeth often requires renewal at this time, and the head should be well turned to one side. The opening into the sinus should be enlarged with the chisel, bone forceps, or burr driven by the hand or electromotor. It is important to remember the exact direction in which this enlargement should take place. It should be both downward, so that the opening is on a level with the alveolar floor of the sinus, and forward, so that it approaches closely to the nasal wall of the cavity. This situation is preferable, as the opening is (*a*) distant from dangerous regions; (*b*) gives the best view of the cavity; (*c*) is in the most favorable situation for drainage, and (*d*) is most suitable for performing the second part of the operation, viz.: the creation of the opening into the nasal chamber. The canine opening is enlarged sufficiently to admit the operator's little finger. The margins of the opening in the bone are kept as smooth as possible, any spicules which may have been driven in with the chisel are carefully removed, and the reflected muco-periosteum is carefully preserved. Care should be taken to avoid injury to the infra-orbital branch of the trigeminus nerve. Otherwise troublesome neuritis may be set up.[1]

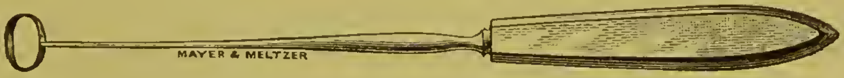
The bleeding from the lining of the antrum is carefully stanched with lengths of sterilized gauze, and the walls are then carefully inspected with a frontal electric searchlight. The diseased mucous membrane is now dealt with, and all redundant or polypoid tissue is completely removed. This can be done by Grünwald's forceps (Fig. 496), which will only embrace any hypertrophied tissue which projects above the surface, or by sharp spoons or some form of ring knife, preferably such as that of Myles. (Fig. 497.) It is often advised to curette the walls vigorously and freely, but it is difficult to imagine how a good result can be expected from entirely denuding the sinus of its mucous lining and then rubbing a strong corrosive on to the bare walls. On the contrary, care should be taken to remove only such tissue as is diseased. In some cases the antrum will be found almost completely filled with polypoid masses of hypertrophy. (Fig. 498.) In other cases the mucosa may be found to be thickened only in parts. The regions which should be most carefully examined

FIG. 496.



Grünwald's forceps.

FIG. 497.



Myles' ring knife, used for curetting the sinuses.

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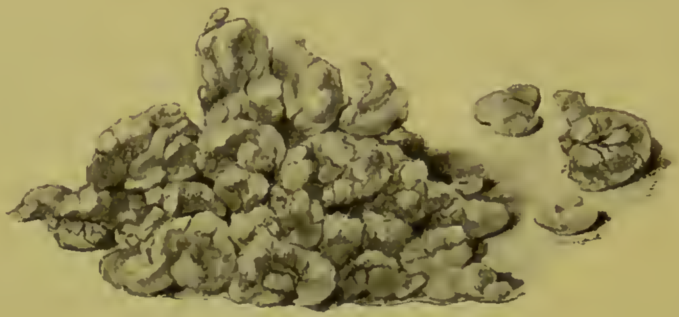
[1] De Roaldes. Transactions of the American Laryngological Association, 1899.

are (*a*) the deepest part of the internal or nasal wall—*i. e.*, near the natural opening and in the neighborhood of the ethmoid bone; (*b*) the irregularities on the floor of the sinus, especially between any projections of the dental roots, and (*c*) the outer part of the anterior or facial wall and the malar fossa.

FIG. 498.



Life-size drawing of polypoid hypertrophies removed from a maxillary sinus. (STCLAIR THOMSON.)

Caries of the walls is much less frequently met with than some pathological investigations would lead one to expect. Once the toilet of the cavity has been completed we proceed to the second step of the operation.[1]

Creation of a Nasal Opening. During this part of the operation blood is very apt to find its way into the postnasal space, and it is a useful precaution to insert into the cavum pharyngeum a small sponge attached to a tape. The nasal cavity on the affected side is first well illuminated, and the anterior third of the inferior turbinal is amputated in the following way: With a stout pair of Panzer scissors (curved at an angle and also on the flat) the attachment of the anterior third to the outer nasal wall is cut through, and this portion is then removed with a cold wire snare. This proceeding may, with advantage, be carried out under cocaine some time before the major operation. It gives us free access to the partition between the nose and antrum which we wish to break down. This is done with the chisel and hammer through the canine opening, working close to the floor of the sinus and as anterior as possible under cover of the severed attachment of the inferior turbinal. As soon as the chisel has penetrated the wall a Krause canula with probe-pointed trocar should be introduced, to define and increase the opening. It can then be enlarged with the chisel and hammer, or suitable burrs, until at least the anterior third of the outer wall of the inferior meatus has been resected. There is little fear of resecting this wall too freely, as it always shows a remarkable tendency to contract afterward, and many cases of failure are due to the inadequacy of the nasal opening. While this opening is being made care should be taken, either by plugging the nose on that side with gauze or by introducing the little finger into it, that the septum is not injured.

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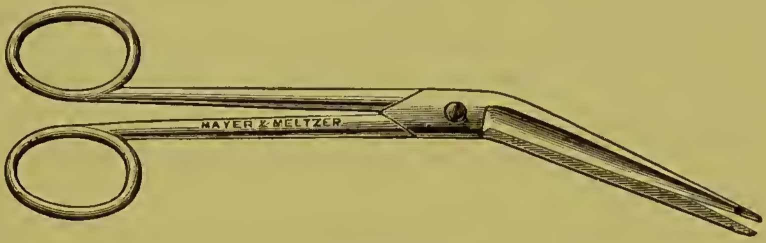
[1] The original canine operation known as Desault's or Küster's terminated here, and subsequent treatment was carried out through this opening.

The maxillary cavity is now once more dried of any blood which may have accumulated. It is frequently advised to paint the walls with a 10 or 20 per cent. solution of chloride of zinc; the cavity is well powdered with iodoform, and is then firmly packed with one long strip of dry iodoform ribbon gauze, which should be about one and a half inches wide and with selvage on both sides. The end of the gauze ribbon should be led through the nasal opening until it appears at the nostril. The muco-periosteum reflected from the canine opening is carefully lifted back into position, and any sponges in the postnasal space or angle of the jaw are removed.

FIG. 499.



Panzer's scissors.

It is recommended by Luc and others to carefully suture the buccal wound with catgut. This step is not only tedious and quite unnecessary, but the insertion of stitches appears rather to retard rapid union. The sides of the wound fall into complete apposition, and if a pad of cotton-wool is placed externally, and mastication on that side avoided for a few days, union is both rapid and complete.

After-treatment. There is seldom any marked general reaction after this operation, and the physician need not be alarmed if the cheek on the same side becomes so swollen as to partly occlude the eye. The feeling of distention is relieved by a firm compress of cotton-wool, or by hot fomentations. For a few days the diet should be fluid and should be swallowed through the opposite side of the mouth. The mouth should be rinsed out frequently with some cleansing alkaline lotion.

The ribbon gauze is removed on the fifth (Luc) to tenth day. The extraction is easy if the resection of the anterior end of the inferior turbinal and of the antronasal well has been adequate. Otherwise it is apt to be so painful that it is well to administer some nitrous oxide gas. The gauze is generally free from fetor, and in its removal it clears away any debris left from the operation. The large opening into the inferior meatus is sufficient for natural drainage, but it is as well to wash the antrum out through it for a few weeks until after an interval of a few days the lotion used returns clear. This cleansing is easily carried out with a short length but full-bored silver Eustachian catheter, and some sterile salt solution. For some time the mucus of the nose is apt to dry into crusts along the irregular border of the artificial hiatus; but this disappears as the margins heal over, and, as already stated, the large opening shows a remarkable tendency to rapid contraction. The cure is generally complete in from three to six weeks.

Indications for Treatment. Surgical treatment of the maxillary sinus is not associated with the possibility of any disfigurement of the face, and is so free from risks that our ambition should be to obtain a complete and lasting cessation of the discharge in all uncomplicated cases. Treatment through the antronasal wall may be tried in patients who have intact teeth in the upper jaw, and who prefer to essay a simpler method before submitting to the canine operation. When a suitable tooth socket is available the method of washing out through the alveolar opening may be given a trial of a few months. If either of these methods do no more than reduce the secretion to a tolerable inconvenience many patients may decline further interference. Whenever the teeth are intact and when the patient is anxious to have a radical cure effected, the canine operation should be carried out.

Chronic Suppuration in the Frontal Sinus. Symptoms and Diagnosis. In a large number of cases of frontal sinusitis there are no subjective symptoms which point particularly to that cavity.

When the outflow of pus into the nose is obstructed we may get local symptoms of pain, tenderness, lacrymation, etc., similar to those met with in acute cases. But in the chronic, "latent" cases it is seldom that any of the subjective symptoms are at all trustworthy. Thus pain and even tenderness over the superciliary region or frontal headache may be due entirely to pus in the maxillary sinus, while the frontal cavity in another case may be full of pus without there being either frontal headache, pain, or neuralgia. In some such cases the headache may even be referred to the occipital region.

Still, in all suspected cases it is well to note the presence of frontal pain or headache, and to test carefully the sensitiveness of the region. Pressure should be applied first to the apparently healthy cavity, so that the difference by contrast will be recognized. The supra-orbital nerve must be avoided.

Another external method of examination is the test of *transillumination.* The same preparations are required as for applying the test to the maxillary sinus, but the electric globe instead of being encased in a movable glass hood (Fig. 484) is fitted with an opaque vulcanite cap which directs the rays in one longitudinal axis. This is pressed firmly against the lower wall of the sinus, under the inner third of the eyebrow. If there is nothing to interfere with the passage of the light rays the clear frontal sinus will be lit up with its extensions upward and outward, and in some cases the septum and partial dissepiments will be defined. If one sinus only is obstructed these points become more evident by contrast.

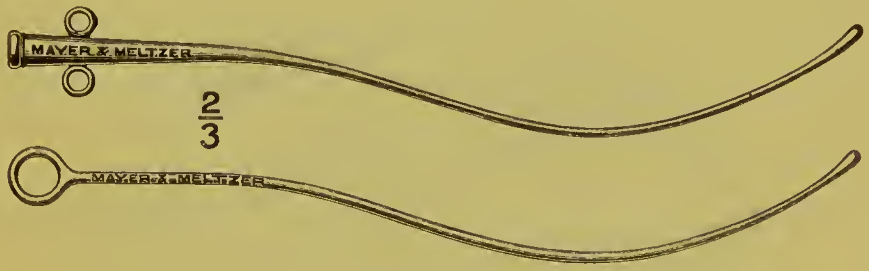
It is impossible to compare the two sides simultaneously, as we do in applying the test to the maxillary sinus. Hence, Lubet-Barbon suggests that the rubber cap containing the lamp should be pressed against the mid-line of the forehead, two or three centimetres above the root of the nose. On switching on the current a comparison can be made of the way in which the light rays traverse each sinus to light up the antero-superior angle of the orbit.[1]

A form of transillumination lamp has also been designed by which both cavities can be transilluminated at once from their orbital wall, so that the results can be compared.[2]

Objections to the Transillumination Test. This test is much less satisfactory for the frontal than it is for the maxillary sinus. The anatomical arrangements and relations of the cavity lend themselves less readily to transillumination than do those of the maxillary sinus. Pus may be present in the sinus and yet the test may fail because it may be slight in amount, lying only on the floor, and the bone may be particularly translucent. Pus may be absent, and yet the test may fail to light up the cavities owing to the great thinness of the walls, or even owing to their entire absence, or to the presence of a solid new-growth, such as an osteoma.

It can only be regarded as a subsidiary aid and as confirmatory of other tests, to be shortly described.

FIG. 500.



Frontal sinus canula.

Nasal Examination. The discovery of pus in the middle meatus of the nose should prepare the observer for finding that its source is the frontal or maxillary sinus, or both. If the pus is seen high up anteriorly, if it is accompanied by polypi, if it recurs rapidly when wiped away, if it flows more freely when the middle turbinal is pressed toward the septum, and if there is no marked cacosmia, the evidence points to the probability of the upper cavity being its source. Grünwald has suggested that by cleaning the middle meatus, and then carefully packing the region of the hiatus semilunaris and waiting a few minutes, we can see whether the pus reforms above or below the plug. The method has not met with general adoption, and the evidence obtained is still problematical. More certain evidence can be obtained by washing out the cavity itself.

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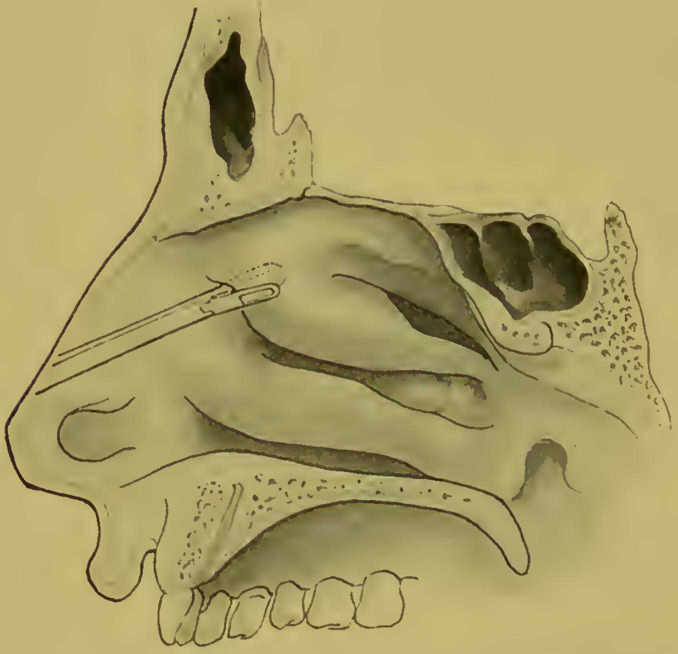
[1] Bulletin de la Société Française d'Otologie, 1899, tome xv. p. 248.

[2] Furet. Archives Internat. de Laryng., Mars et Avril, 1899, p. 155.

Sounding the Frontal Sinus. The observations of Lothrop on the cadaver show that in the majority of instances it is impossible to pass a probe from the nose up into the frontal sinus, and it must be still more difficult to do it in the living subject.

The care with which this attempt should be carried out is best impressed upon us by bearing in mind the case recorded by Mermod.[1] This experienced rhinologist diagnosed an escape of watery fluid from one nostril as originating in the frontal sinus. He tried to catheterize the cavity, but was arrested owing to the pain the proceeding induced. The patient died some days afterward, and at the post-mortem it was found that he had no trace of frontal sinus. The fluid had escaped through a small opening in the anterior fossa of the skull and must have been cerebro-spinal fluid. This had become infected, although the attempt to sound the postulated frontal sinus had been carried out with every aseptic precaution.

FIG. 501.



Amputation of the anterior end of the middle turbinal. Dividing the attachment to the outer nasal wall.

It is wiser to secure free access to the frontonasal duct by amputating the anterior end of the middle turbinal. This procedure will in any case be required as a method of treatment if the sinus is found affected. The sinus can then in many cases be catheterized.

Amputation of the Anterior End of the Middle Turbinal. The region is rendered ischæmic with adrenalin, and cocainized. In this way the part to be removed is generally well exposed and stands out from the neighboring parts. With a stout pair of Grünwald forceps or Panzer scissors the anterior attachment to the outer wall is cut through, so as to free a head around which a cold snare can be passed and the extremity removed. In cases where it is difficult to introduce the forceps along the agger nasi to the attachment of the middle turbinal the blades may be applied to the lower margin, about half an inch from the anterior extremity, and by then biting out a portion the loop of the wire snare can be passed around the head of the turbinal, which is easily removed.

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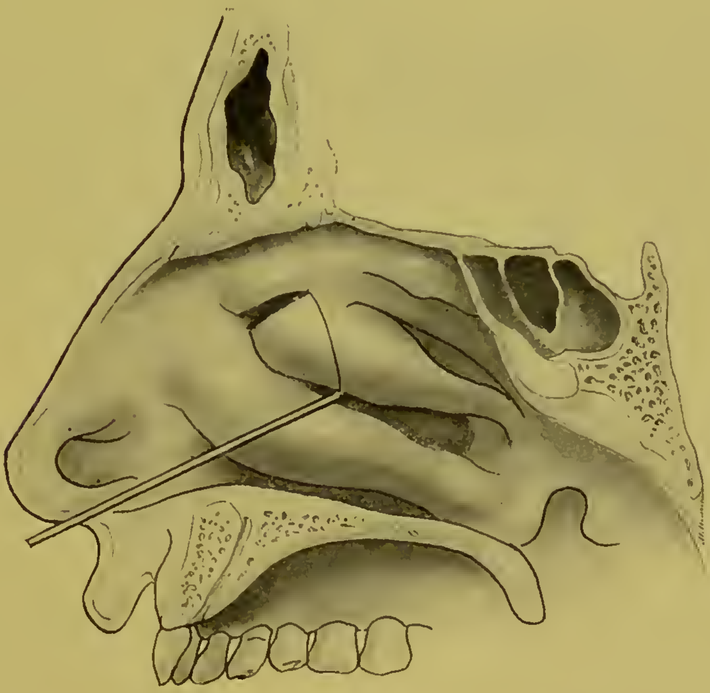
[1] Annal. des Mal. de l'Oreille et du Larynx, April, 1896, xxii., No. 4.

Diagnosis by Exclusion. If the sounding of the frontal sinus has failed, all the points already referred to are uncertain, and we are still in doubt as to whether the discovery of pus in the middle meatus originates from the frontal or maxillary sinus, or both. This point can really only be positively settled by a process of exclusion, which is done as follows:

FIG. 502.



Amputation of the anterior end of the middle turbinal. Removing the separated extremity with a wire snare.

The maxillary sinus must be explored in one of the two methods already described—either through an empty tooth socket, or by puncturing the inferior meatus. The antrum is then thoroughly cleared by syringing through it air, sterile salt solution, a teaspoonful or two of hydrogen peroxide, more salt solution, and then air. In this way we can determine (1) if the cavity contains pus, and (2) that, if present, it has been temporarily thoroughly expelled. If now we let the patient wait for from ten to thirty minutes, and again on examining him find pus in the middle meatus, we can be certain that this can originate in no other than the frontal sinus or anterior ethmoidal cells.

In carrying out this test it is important to avoid causing any bleeding in the nasal chamber, as this militates against the result. The nasal chamber should also be scrupulously cleared of any purulent matter first, as otherwise we could not say that any discovered there later had come from an accessory sinus. It is hardly necessary to do more than refer to the method of exploring the sinus by puncturing its floor from the nose. This method is so dangerous that it is quite unjustifiable. It will be referred to later under the head of Treatment.

Complications. Many of these have already been touched on. The most common are suppuration in the anterior ethmoidal cells, and the corresponding maxillary sinus. According to Luc it is exceptional to find the frontal affected without participation of the maxillary sinus, although uncomplicated suppuration in the latter cavity is frequently met with.

Treatment. INTRANASAL TREATMENT: *Puncture of the Floor of the Sinus.* The method recommended by Schaeffer[1] of puncturing the floor of the frontal sinus from the nose is only mentioned to be condemned. The anatomical irregularities which render such a proceeding much too dangerous have already been referred too. It is common knowledge that a rhinologist in Paris, believing that he was affected with an acute frontal sinus suppuration, attempted to thrust a trocar and canula from his nose into this cavity. He died shortly afterward, and the instrument was found to have penetrated the anterior fossa of the skull.

Catheterizing and Washing-out the Frontal Sinus. Observers differ as to the frequency with which the frontal sinus can be explored from the nose. Some authorities believe that they succeed in catheterizing the sinus in 50 per cent. of the cases, but most of us acknowledge that we are not so frequently fortunate. In any case the operation is greatly facilitated by amputation of the anterior end of the middle turbinal. (Fig. 502.) In those cases where the method is feasible it is best done with a Hartmann canula, which has a double sigmoid curve. (Fig. 503.) This is introduced into the middle of the centre of the middle meatus and then gently directed upward and forward until the point is felt to enter a free cavity, and is found to be 6 to 7 cm. distant from the nasal orifice. It is often impossible to say whether the canula has really entered the frontal sinus or whether the point is merely engaged in one of the fronto-ethmoidal cells. It is in this method, and in such cases, that Spiess' employment of the Roentgen rays is so valuable. With the shadow thrown upon the screen it is extremely easy to follow the passage of the point of the instrument through the nose until it enters the frontal sinus, of which the walls are well defined.[1]

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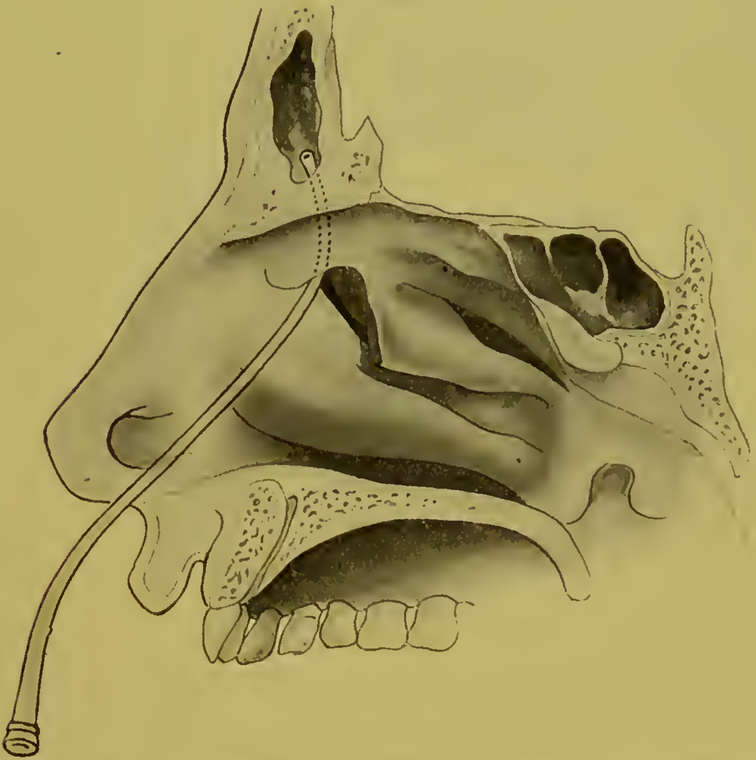
[1] Deutsch. med. Wochenschrift, October 9, 1890, p. 905.

When the cavity can be catheterized from the nose it should be washed out daily with liquids similar to those indicated for suppuration in the maxillary antrum. Whether a cure will be effected is very problematical. Tilley gave the method a careful trial in four cases without any permanent result except in one case.[2] However, in cases where the cavity can be easily reached from the nose by this method the patient is to a great extent relieved of any risk of the dangerous complications which might otherwise ensue.

FIG. 503.



Method of catheterizing the frontal sinus after removal of the anterior end of the middle turbinal. The drawing shows the hiatus semilunaris, with the edge of the processus uncinatus below it, and the ethmoidal bulla above.

The indications for the employment of the proceeding are therefore (*a*) as a first step in all treatment, and (*b*) as a precautionary measure in such patients, especially young women, who decline an external operation.

The External Operation. This method of treating the frontal sinus by operation through the forehead was first described by Ogston,[3] but it was independently conceived by Luc[4] who has given considerable attention to the method. The patient is prepared for operation in the usual way, and in addition the eyebrow on the same side is entirely shaved off and the skin of the forehead on that side purified twelve hours beforehand and an antiseptic dressing applied. A general anæsthetic having been administered the skin of the eyebrow on the affected side is drawn well up on to the forehead so that the part lying immediately below is pulled up on to the edge of the forehead (Bryan). A curved incision is then made down to the bone along the inner third of this region, reaching from near the middle of the eyebrow to opposite the anterior palpebral ligament. (Fig. 504.) The inner extremity of the

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[1] Spiess. Journal of Laryngology, November, 1899.

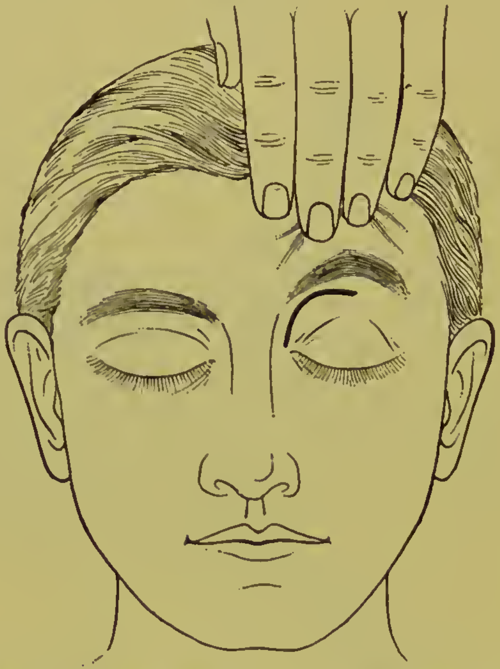
[2] Lancet, July 14, 1900

[3] Ogston. The Medical Chronicle, December, 1884.

[4] Luc. Société Française d'Otologie, etc. Paris, Mai, 1896.

61

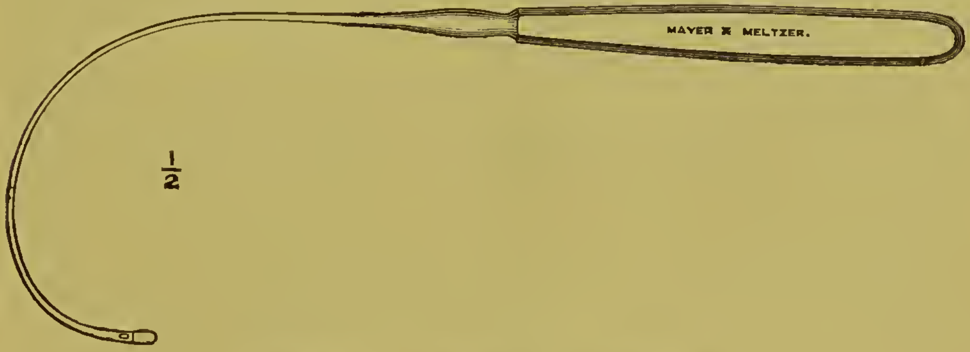
FIG. 504.



External operation on the frontal sinus. Showing the situation for making the skin incision while drawing the eyebrow up on to the forehead.

incision will terminate opposite the suture of the nasal bone with the nasal process of the frontal, while the outer end will be internal to the supra-orbital foramen. In the latter direction it can be extended, if required. At the end of the operation, when the soft parts are allowed to fall back into place, this incision will be almost entirely concealed. With a raspatory the soft parts are turned upward and downward so as to expose the anterior wall of the frontal sinus. A half-inch trephine applied at the point indicated in Fig. 495 will never fail to expose the sinus, if one is present. Instead of a trephine, however, I recommend that the cavity be opened with a chisel and hammer. It may present considerable thickness. Throughout the operation great care must be taken not to press on, displace, or otherwise injure the eyeball. As soon as the sinus is penetrated careful exploration should be made with a blunt probe to determine not only the direction and extent of the cavity, but to positively ascertain that the lining membrane of the cavity has been exposed and not the outer surface of the dura mater. The pyogenic membrane filling the sinus sometimes presents an external smooth, dark, purplish-gray surface which at first glance might be mistaken for the dura mater. In some cases as soon as the sinus is opened yellow pus makes its escape; it is never possessed of the same putrid odor as that from the antrum of Highmore; it is never large in amount, and in some cases no pus may be encountered, although the cavity may be more or less completely filled with fungoid, papillary, myxomatous-like hypertrophies. In order to remove these the opening into the sinus may have to be enlarged with chisel and hammer or bone forceps, upward on the forehead and outward toward the outer margin of the eyebrow. This orbital arm of the sinus is much more concave than the ascending frontal. In securing this access to the cavity, it is not by any means necessary to remove the entire anterior wall, but only so much as will allow inspection of the contents. The enlargement of the opening should be chiefly on the antero-inferior wall, below the glabella and above the suture of the frontal with the maxillary and lacrymal bones. This gives the freest access to the part which requires most careful treatment—the frontonasal canal—and it is here that the scar is best hidden by the eyebrow. When a sufficient opening has been secured the degenerated mucous membrane should be carefully removed by plucking it off with Grünwald forceps or a Hartmann conchotome. The further recesses of the sinus, especially the outer angle, must be carefully cleared with the curette, but this instrument should be used with great care, especially on the thin posterior wall. It is possible that some of the fatal cases of septic osteomyelitis, which have followed this operation, have been partly due to too "free curettage." The part of the sinus which demands the most careful toilet is the floor and the frontonasal duct. When not evident this latter can readily be found with Panas' curved-eyed probe. (Fig. 505.) For reasons already given no attempt should be made to pass this upward from the nose; but with the tip of it in the sinus the ostium is readily found, and by imparting to the probe

FIG. 505.



Panas' probe for exploring the frontonasal duct.

a gentle curving action downward, backward, and then forward the eyed extremity will appear at the anterior naris. The operator should introduce his little finger into the nostril to meet the probe as it descends, and he may be surprised in his earlier cases to find that it is encountered in the nasal cavity much further back than he would have imagined. The probe is threaded with a stout silk ligature and withdrawn. To the silk end now projecting from the sinus a strand of iodoform ribbon gauze, one to one and a half inch wide, and with a selvage, is attached and drawn down into the nose and out through the nostril. The surgeon seizes the upper extremity of the gauze ribbon projecting from the frontal sinus with one hand and the lower end with the other, and by sawing it upward and downward he will not only define the frontonasal duct, but break down some of the friable ethmoidal cells along its track. These cells should be further cleared away by the use of a ring knife, or sharp spoon, from above. Once the frontonasal canal has been defined there is practically no danger in working along it downward, inward, and backward. Even if directed too much outward, the only risk would be that of damaging the os planum (Fig. 481), and entering the orbit where the capsule of the orbit would prevent any injury to the eye. It is with the upper posterior wall that extreme caution should be used. As the success of the operation to a large extent depends on the complete removal of the anterior ethmoidal cells this part of the operation should be carried out with care. With the little finger introduced from above into the funnel of the frontonasal duct as a guide these cells may also be cleared from below by working around the tip of the finger with a pair of Grünwald forceps.

When the parts have been satisfactorily cleared it is recommended to swab out the cavity with a solution of chloride of zinc, forty grains to the ounce. This is unnecessary if the toilet of the sinus has been well carried out. The remaining steps of the operation are varied by different operators.

Luc formerly employed a rubber drainage-tube with a funnel-shaped extremity. The latter was lodged in the sinus, while the tube passed down the frontonasal duct to appear at the anterior naris. The external forehead wound was closed at once, and any subsequent treatment was carried out through the drain, which was generally removed at the end of eight or nine days.[1]

He has latterly[2] abandoned the rubber drainage-tube, and now, after dusting the cavity with iodoform gauze, he packs it with a ribbon of iodoform gauze, which he leads down into the nose. The external wound is closed at once and the gauze is removed on the second or third day, by which time it has ensured the patency of the frontonasal duct.

Walker Downie[3] does not attempt any drainage into the nose. He packs the sinus firmly with a strip of gauze which he leads out through

[1] Archives Internat. de Laryngol., 1896, tome ix., No. 3, p. 163.

[2] Loc. cit.

[3] Glasgow Medical Journal, May, 1899.

a counter-opening below the original wound, which is completely closed. The gauze is left in place for seven to fourteen days, and when extracted through the counter-opening the wound is found to be cicatrized.

I have already referred to the danger of indiscriminate curetting. Another risk is that attending immediate closure of the external wound, and the retention in an unyielding, bony cavity with greatly denuded walls of secretion which could hardly have been completely sterilized, in spite of every care.

I have, therefore, always avoided immediate complete closure of the forehead wound. After drying the cavity well I have firmly packed it with a dry strip of iodoform ribbon gauze, of which the extremity was left projecting from the internal angle of the wound, the outer portion of which may be closed with a few silkworm-gut stitches. A few layers of cyanide gauze wrung out of boracic lotion, and covered with a supporting pad of alembroth wool is then fixed on with a bandage like an eye dressing. No rubber or gauze drain is inserted through the communication with the nose. Hence there is no risk of a "drain" acting as an obturator, instead of as an outlet. The patency of the enlarged frontonasal duct is demonstrable in most cases afterward both by the ease with which the lower part of the sinus can be washed out from the nose, and also by the fact that patients can force air from the nose up into the sinus. Not only does the patient feel the distention of the cavity, but the impact of the compressed air can, in some cases, be both seen and felt against the frontal cicatrix.

Progress. For some time the patient may complain of diplopia, particularly if the pulley of the superior oblique was interfered with during the operation. This diplopia generally passes off in a week or two. Patients may also notice a numbness of the forehead on the affected side, due to division of some of the branches of the supraorbital division of the fifth nerve.

The external dressing may be changed at the end of twenty-four hours, so as to bathe the covered-up eye with boracic lotion. The packing of the sinus can be left in place for three, five, or more days, according to the absence of any suppuration or reaction. Any tension can be relieved by gently pulling out and cutting off an inch or two every second or third day. When the whole of this first packing is removed at the end of five to ten days the inside of the sinus should be carefully inspected and syringed out with sterile salt solution or boracic acid, which should pass down freely into the nose if the fronto-ethmoidal cells have been adequately dealt with. Any débris or granulation obstructing the nasofrontal duct can be cleared away with a curved, silver, Eustachian catheter. The packing may have to be renewed at intervals until about two or three weeks from the operation, when the cavity will appear so healthy, and the large duct into the middle meatus so permanently patent, that there need be no hesitation in allowing the external wound to close. A firm compress is applied over the bony defect in the anterior wall of the sinus, so as to partially obliterate the cavity. Any subsequent washing out can be conducted from the nose. Unless an extensive amount of the anterior wall has been removed there is very little disfigurement, and the scar in most cases is trifling. (Figs. 506 and 507.)

FIG. 506.

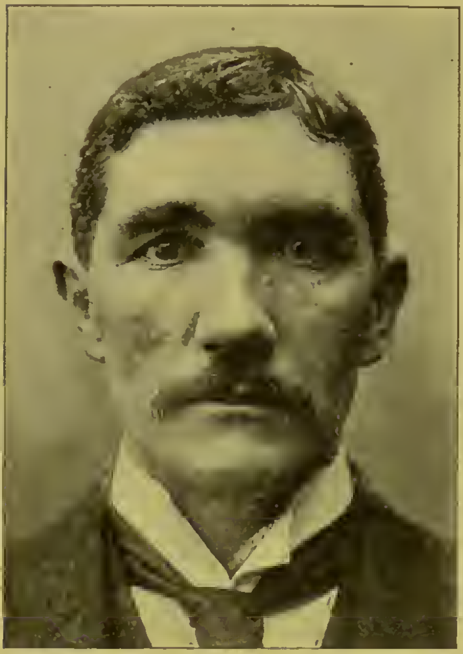


FIG. 507.

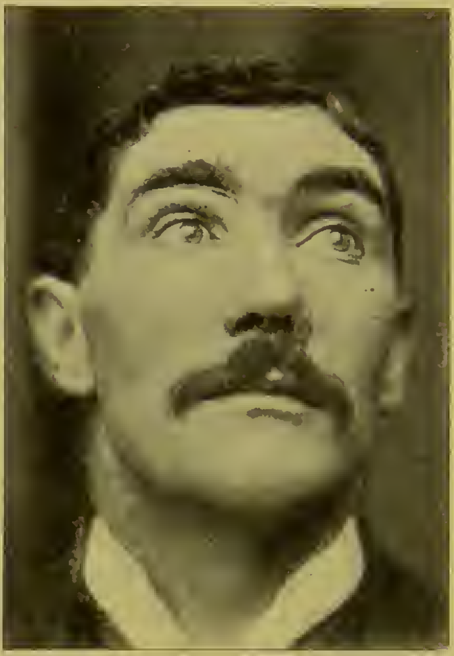


FIG. 506.—Frontal sinus operation. Untouched photograph, showing how the scar is concealed below the eyebrow. (Author's case.)

FIG. 507.—Frontal sinus operation. Untouched photograph of the same case seen in Fig. 506, showing the situation of the scar when the patient raises his head and elevates his eyebrow. Nasal suppuration was completely arrested after operation on both antra, both ethmoids, and the right frontal sinus. The latter cavity was opened twice, owing to a pouch toward the external orbital angle having been overlooked at the first operation. (Author's case.)

Kuhnt's Operation. In the above operation a considerable amount of the cavity is obliterated by the coaptation of healthy granulating surfaces, but it is not entirely obliterated. But sinuses are occasionally met with which are so capacious, extending back to the optic foramen and out to the frontosphenoid suture, that the extensive granulating surface fails to cicatrize over and continues to secrete pus into the nose. It is in such cases that a radical cure can hardly be hoped for except by Kuhnt's method, which consists in chiselling away the entire anterior wall of the sinus and then pressing the soft parts covering it down into the cavity until they are applied to the posterior wall. There can be little doubt as to the satisfactory result in regard to nasal suppuration secured by this plan, but the resulting disfigurement is so marked that few patients care to submit to it. Possibly it might find its application in persons who are prevented from earning their living by the sufferings or inconvenience entailed by the persistence of the sinusitis, and to whom appearances are of little moment.[1]

Suppuration in the Ethmoidal Cells. *Synonym:* Ethmoidal sinusitis.

Etiology The direct manner in which the ethmoid is exposed to external influences, and its anatomical arrangement, readily explain the frequency with which suppuration is encountered in the ethmoid labyrinth. It is probably attacked primarily in a large number of cases, and, owing to its position in the centre of the accessory system, suppuration readily extends from it to the other sinuses. That it may become secondarily infected with discharge from any of these cavities is also very possible, and Luc has suggested that in the treatment of maxillary sinusitis by washing out through the alveolar opening we run the risk of driving infective matter into the ethmoid cells. However, in the majority of cases it is probable that the ethmoiditis is primary, for we often get pus in these cells without encountering it in the frontal or maxillary cavities, whereas it is very seldom we find the two latter attacked (and especially the frontal) without implication of the ethmoid labyrinth.

The external sources already referred to are the most common causes of ethmoiditis, but owing to its exposed position it is doubtless more commonly infected by the conveyance of septic infection by the surgeon from other cavities, from the reckless use of the galvanocautery, or from incomplete operative interference. Secondary suppuration may also reach the ethmoid region from the orbit, and suppuration in the anterior fossa of the skull has been known to make its way through these cells into the nose.

Symptoms. It is well to recollect that the posterior group of ethmoidal cells are smaller and their mouths are much more open. Hence disease in them is less commonly met with, less troublesome, but more difficult to treat than that of the anterior group. The anterior group of cells increase in size from above downward and from before backward. One of the largest is called the bulla ethmoidalis. It is generally concealed just below the anterior extremity of the middle turbinal, and somewhat overlies the cleft of the hiatus semilunaris, of which it forms the upper and posterior lip, just as the prominence of the processus uncinatus forms the lower lip. The opening of the bulla is on its upper and posterior surface, close under the attachment of the middle turbinal. Other cells open above the hiatus, into which their secretion naturally trickles. Among the most important is the frontal bulla and the fronto-ethmoidal.

According to this anatomical division of the ethmoid cells we can first of all divide the study of ethmoiditis into suppuration in (*a*) the anterior ethmoidal cells, and (*b*) posterior ethmoidal cells.

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[1] W. Milligan. Etiology and Treatment of Suppurative Disease of the Frontal Sinuses. Lancet, February 19, 1898. E. J. Moure. Le Traitément des Sinusites. Rev. hebd. de Laryngol., 1898.

The Anterior Ethmoidal Cells. Adopting the classification of Grünwald we may divide suppuration in these cavities into (*a*) closed suppuration, and (*b*) open suppuration.

(*a*) *Closed Suppuration.* It is now established that the orifices of a cell may become obstructed by inflammation and its cavity distended with suppuration. In such a case the distended portion of the middle turbinal will cause symptoms of pain and obstruction according to its situation and the direction in which it tends to expand, either toward the nasal cavity or toward the orbit. In the former case the chief complaint will be of increasing nasal obstruction, with a feeling of distention referred to the bridge of the nose. Weight and oppression toward the forehead, with a feeling of tightness and heat in the nose, lead to inspection of the nasal chamber, when the normal situation of the middle turbinal is seen to be replaced by a smooth, rounded body, impinging on the septum and more or less completely blocking up the middle and inferior meatus. To the probe it feels firm and resisting, sometimes decidedly bony, and sometimes like eggshell, but frequently its true character is only discovered on puncturing it with the probe, or cutting it across with a wire snare. It is then found to be a hollow, bony cyst, with a smooth lining membrane, sometimes containing polypoid mucous membrane and filled with mucoid contents, or with pus which may be strikingly fetid.

The cases in which the contents of a cystic dilatation of the ethmoid, with or without suppuration, make their way toward the orbit have long been recognized and have generally come under the notice of the ophthalmic surgeon. Preceded by some darkening of the lower eyelid, or by some congestion and infiltration, a swelling makes its appearance at the inner angle of the orbit, displacing the eyeball outward and downward. This may take place quite painlessly. Sometimes this closed ethmoidal suppuration pointing toward the orbit may develop suddenly, with intense pain, fever, rigors, swelling and œdema of the eyelids, and a fluctuating swelling to the inside of or below the eyeball. If such a case is unrelieved it may go on to suppuration within the cranial cavity and fatal meningitis. Although apparently primary these acute cases are doubtless in the majority of instances exacerbations of a chronic condition, and it is well to remember that they may supervene on a chronic manifestation or be induced in unsuspected cases by surgical traumatism.

Treatment. The circumscribed ethmoidal empyema found in the middle meatus should be removed with a cold snare, forceps, and curette. The remaining ethmoid region should then be carefully inspected and treated accordingly.

When the direction is that of the orbit the swelling may have to be dealt with by external incision, but communication with the nose should be established as soon as possible, so as to secure good drainage and enable further treatment to be carried on from the inside.

(*b*) *Open, Latent, or Manifest Empyema.* This is the most common form of affection of the ethmoid. It is frequently overlooked, and the actual pathological affection is apt to be mistaken for nasal polypi or atrophic rhinitis, which are but two of the consequences, although often the most prominent symptoms.

Symptoms. In this form of nasal suppuration the patient may complain of almost any of the symptoms which have already been described as associated with affection of the sinuses. Still there is seldom the faceache or neuralgia, although a dull heaviness at the root of the nose is often noticed. A general sense of mental hebetude, aprosexia, and disinclination for mental work is more often complained of. Depression and melancholia are more often traceable to this form than to suppuration in the larger sinuses. A feeling of distention of the bridge of the nose may be complained of, and actual enlargement may even be noticed. Tenderness can sometimes be elicited, especially by pressing on the lacrymal bone at the inner angle of the orbit. The discharge from the nose is seldom so copious as with other sinuses. The patient rarely complains of the same cacosmia, but on the other hand he is much more apt to be affected with anosmia. Although he may use fewer handkerchiefs he often has greater difficulty in clearing the nose, owing to the secretion drying into crusts. In consequence of the tendency to dryness of the secretion, and the turbinal atrophy, the secretion tends to be inspired toward the back of the nose, and so, in some cases, to present itself in the form of atrophic or crusty postnasal catarrh.

Examination will reveal pus in the middle meatus. In many cases it is accompanied by polypi, and it is in such instances that the pus is fluid and yellow. In certain cases the pus tends to dry into adherent greenish-yellow crusts, the epithelium gets eroded, and the turbinals atrophy, so that the appearances are much like those described under the heading of Ozæna.

Although pus from the anterior ethmoidal cells must of course make its escape in the first instance into the middle meatus, it is often found lying on the floor of the nose, and adhering to the margin of the middle turbinal, whence it passes upward into the olfactory cleft.

In determining the origin of the suppuration it is a good plan not to wash out the nose with a cleansing lotion, but to carefully lift or wipe out the crusts with nasal dressing forceps, cotton, and a little cocaine, carefully avoiding any bleeding. In this way any pent-up pus may sometimes be discovered and traced to its source. The use of the nasal probe is essential, and when carefully used it will in many cases, especially those associated with polypi, detect carious bone. After the middle meatus has been cleansed, a medium-sized blunt probe is insinuated between the outer nasal wall and the middle turbinal, which is then pressed inward. This will sometimes allow the escape of fluid pus. This pus might come from the anterior ethmoidal cells or from the frontal sinus. If carious bone is felt in the neighborhood of the ethmoid it points to ethmoiditis, although this does not exclude the presence of a frontal sinusitis which often accompanies it. The mere sensation of "bare bone" is not sufficient to found a diagnosis of caries. The muco-periosteum is so thin and closely adherent over the parts in the concavity of the middle turbinal, that the bone can be felt in many cases where there is neither pus nor any symptoms suggestive of ethmoiditis. It is otherwise when the probe meets with roughened and readily breaking-down spicules of bone, or on slight firm pressure enters small cavities in the ethmoid.

The diagnosis of ethmoiditis can also be arrived at by the method of exclusion already described. In all cases it is a good routine plan to commence by excluding the maxillary sinus. When the symptoms already described as indicative of ethmoiditis are present it is sometimes difficult to say if the frontal sinus is also affected. The methods suggested by Grünwald of damming up the various ostia might be tried.

If it is possible to catheterize the frontal sinus, and pus can be washed out of it, the diagnosis is facilitated. In most cases, however, it will first be necessary to do the typical amputation of the anterior end of the middle turbinal, and there need be no hesitation in taking this step, as it is the first one necessary in initiating treatment of the ethmoiditis. (Figs. 501 and 502.) Once this is done the frontal sinus can be washed out in a majority of cases. In some the involvement of the frontal cavity will still remain uncertain. In such cases we should proceed with the treatment of the affected ethmoidal cells, and the persistence of pus from high up anteriorly in the middle meatus will indicate that the uppermost sinus must be dealt with. If there are no other means of determining the continued escape of pus the urgency of the symptoms may justify an external exploratory operation through the incision already described. If the frontal cavity is found healthy, as in one of my cases, the wound can be closed at once, and no perceptible scar is left.

Treatment. In many of the slighter forms of ethmoiditis only palliative treatment is called for. These are the cases in which a small quantity of mucopurulent secretion takes place, sometimes dried into "films," "casts," crusts, or merely into "pieces like goldbeater's skin," as I have heard patients describe them. These frequently form in the night, sometimes in one nostril only, and all that the patient requires is a cleansing alkaline lotion to use in the morning. In these slighter forms the secretion is seldom so dry, or secreted in such quantity, as to form obstructive collections. It is apt to be the only thing the patient complains of, and it is therefore wise not to open up the ethmoidal labyrinth more completely, when infection might only spread and require more or less complete removal of all the cells. Sometimes in such cases the patient is subject to repeated violent "colds in the head," with profuse mucopurulent secretion and the prolonged discomfort of acute coryza. It is then to be considered whether more active measures should not be proceeded with.

Polypi should be removed with the cold wire snare. When sufficiently cleared to enable a complete diagnosis to be made the ethmoid cells must be freely opened up, and this will entail removal of much osseous tissue. In nearly every case the typical amputation of the anterior end of the middle turbinal must be performed. (Figs. 501 and 502.) If this enables a diagnosis of pus in the frontal sinus to be made, and it is decided to open the latter from the outside, the cells can be cleared from above through the floor of the frontal sinus. If this step is not agreed on, and if the frontal is not affected, the opening of the diseased ethmoid cells can be proceeded with.

The anterior end of the middle turbinal having been removed, this exposes the bulla ethmoidalis, the hiatus semilunaris, and the anterior cells. The diagnosis can be now confirmed by the careful use of the probe, which should always precede each subsequent step. As a diseased cell, or an escape of pus is definitely located with the probe, the punch forceps of Grünwald or Hartmann should embrace the diseased spot under the control of the physician's eye, and in the portion removed at each bite carious bone, pus, and myxomatous-like tissue will be found. Before introducing the forceps again the parts should be dried, and the probe should define clearly what the next step is to be. In some cases where the patient has been carefully prepared, and responds markedly to the ischæmic action of adrenalin, the chief part of the disease can be removed at one sitting. In other cases the free bleeding soon limits further operation, and treatment can only be carried out at intervals of ten to fourteen days.[1]

Next to careful use of the probe the most important point is to proceed always in a direction upward and outward. A reference to the topography of the region will show that this would be toward the orbit, and this is a direction of safety, for little harm is done even if the cavity of the orbit be penetrated. The capsule of the eye would limit the progress of the spread of any mischief, and the accident might be revealed by a "black-eye" incident on the effusion of blood below the lower lid. It is otherwise if the direction be upward and inward. The surgeon must avoid most carefully any approach to the olfactory cleft, for it is here that the danger lies of wounding the cribriform plate. Still, I cannot think that there is much danger if the above advice is carefully followed, viz.: (1) to make repeated preliminary exploration with a probe; (2) remove only what falls within the grasp of the forceps and avoid twisting or pulling any portion out, and (3) work always upward and outward.

It has been recommended to place the patient under a general anæsthetic and scrape away all diseased tissue with a ring knife.[2] Although the little finger can be introduced into the nostril from time to time to detect carious areas, still the proceeding must be more haphazard than that above described, since healthy and useful parts are apt to be removed with the diseased, and when a portion of bone is ripped out we are not assured that the fracture of it may not extend to the cribriform plate In an unconscious patient in the prone position, and with blood often flowing freely, it is more difficult to maintain anatomical landmarks, and I have known of a case where the ring knife had broken through the floor of the anterior fossa of the skull, with, of course, fatal consequences.

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[1] W. E. Casselberry. New York Medical Journal, November 24, 1894. A. B. Thrasher. Necrosis of the Middle Turbinal. Ibid., December 7, 1895.

[2] H. L. Lack Transactions of the Laryngological Society. London, 1901.

External operation of the anterior ethmoidal cells has already been described as part of the operation when the frontal sinus is opened from the forehead. It has been recommended to treat ethmoidal suppuration by this route in any case. Entry is obtained by making an incision similar to that already described for reaching the frontal sinus, but it is better to chisel through the frontal bone on its orbital aspect, so as to gain ready access to the ethmoidal cells. In exposing them, care must be taken not to displace and injure the eyeball, as cases of permanent blindness have occurred from doing so.

Prognosis. In many cases a complete cure cannot be looked for, and if, with the removal of the anterior end of the middle turbinal and the opening up of the large ethmoidal cells, the patient's chief symptoms are relieved, he probably will be well advised to put up with a certain amount of muco-pus from the nose, and possibly the use of a daily nasal lotion. A glance at some coronal sections of the skull will show how impossible it is to open up the very highest cells without perilously approaching the floor of the cranium. (Fig. 482.)

Combined Cases of Suppuration in the Anterior Group of Sinuses.

Synonyms: Maxillary, ethmoidal, frontal.

Diagnosis. In many cases where it is difficult to determine the origin of pus seen in the middle meatus it is safest to begin by settling the condition of the maxillary sinus. Rapid recurrence of pus will then point to disease of the frontal cavity, and inspection and the probe will determine the amount of involvement of the anterior ethmoidal cells.

Treatment. A maxillary sinusitis cannot be radically cured so long as it is acting as a reservoir to the frontal sinus. Treatment of the frontal sinus will be unsatisfactory if the ethmoidal cells continue to secrete pus. Therefore in initiating treatment the maxillary sinus should, if possible, be first drained through a tooth socket. The anterior ethmoidal cells should then be restored to as healthy a condition as possible, and a radical operation on the antrum should not be undertaken until a frontal source of re-infection is eliminated.

Indications for Treatment. The frontal is the only one of the accessory cavities whose ostium is situated in the most favorable point for natural drainage. Hence in the absence of obstruction there is not the same tendency to accumulation, and the cavity can rarely become filled. With certain easily applied measures this tendency to obstruction can be further obviated. Besides the necessity of any radical operation being performed through the skin of the face raises the possibility of some disfigurement, while the proximity of the posterior thin wall of the sinus to the anterior fossa of the cranium renders all surgical procedures much more dangerous than those on the antrum of Highmore.

While these considerations induce a certain diffidence in embarking on radical treatment, there are two others which raise the question of attempting a complete cure. The first and most important is, that neglected suppuration in this cavity has undoubtedly been followed by serious results. The second is that neglected frontal sinus suppuration is very likely to infect the other cavities belonging to the anterior group, viz.: the anterior ethmoidal cells and the maxillary sinus. In such cases the amount of pus secreted by the frontal sinus may be small, and the symptoms induced by it may be in themselves trivial, but the indications for attempting a cure of the accompanying ethmoidal and maxillary suppuration may be prominent, but impossible of realization, so long as the upper cavity remains to re-infect them.

In all cases it is well first to try the effect of intranasal treatment. In the presence of troublesome headache, frequent neuralgia, recurring acute or subacute attacks of exacerbation, profuse discharge, or marked secondary results, the position of affairs must be explained to the patient and the external operation advised.

Chronic Suppuration in the Sphenoidal Sinus. **Etiology.** The etiology of chronic suppuration in this cavity is similar to that occurring in the sinuses already considered. The position of the natural ostium is very unfavorable for the escape of secretion, and possibly this is a reason why the secretion escaping from the cavity is particularly prone to dry into crusts. In many cases the sinus is affected at the same time as others situated more anteriorly, and it is said to occur rarely by itself. In the only post-mortem I have seen of a case of sphenoidal suppuration it was, however, the only cavity found affected.

Many cases formerly regarded as simply ozænic have been traced to a suppuration in this sinus.

Symptoms. The symptoms complained of may be classified as they refer to (*a*) the head, (*b*) the discharge, and (*c*) the eyes.

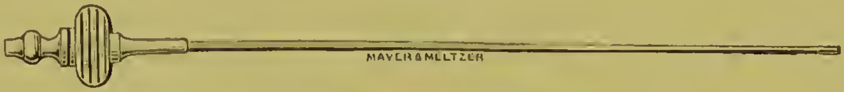
(*a*) In many cases no symptoms of pain are complained of, whereas in others the patient may only seek relief because of some form of headache. This may be only a general diffuse headache or heaviness, or it may be referred to the temples, the forehead, the occiput, or deeply behind the eyes. With this headache, which is sometimes very variable, the patient is apt to complain of many of the mental symptoms already referred to, and I have found that afternoon somnolence appears to be more common with this than with other sinuses.

(*b*) In many cases the patient has made the diagnosis of his case as one of "postnasal catarrh," and there can be little doubt that a number of cases which are ordinarily treated as originating in the pharynx should correctly be located in the sphenoidal sinus. Cacosmia is often complained of, and in advanced cases the sense of smell is more or less completely lost.

(*c*) The eye symptoms, which are often tabulated as associated with suppuration in this cavity, are, in my opinion, only met with in the later stages of the disease, but of course they might be the first to attract attention in patients who had not sought advice or whose symptoms had been misconstrued. These ocular troubles may be of the nature of lacrymation, photophobia, blepharospasm, transitory scotoma. The optic neuritis with complete blindness, and such developments as exophthalmos, basal meningitis, hemorrhage from erosion of the cavernous sinus, etc., are due to extension of disease to the walls of the sinus, and should properly be classified as complications of advanced disease.[1]

Examination. Attention in the first instance may be directed by the patient to the larynx and when dried greenish or yellowish scabs are found in this region (ozæna of the larynx or trachea), the possibility of suppuration in some of the accessory cavities, and most probably the sphenoidal, should be kept in mind. Dried scabs producing atrophic pharyngitis may be found coating the posterior wall of the pharynx and the roof of the nasopharynx. They may be found lying on the back of the soft palate and generally in a less dried-up condition hanging about the choanæ. It is important to carefully inspect this region, as the escape of liquid pus from above the middle turbinal into the postnasal space could hardly indicate other than an origin in the sphenoid sinus or posterior ethmoidal cells.

FIG. 508.



Canula for washing out the sphenoidal sinus.

In the majority of cases the flow of pus is chiefly backward, but in many cases it will also be visible to anterior rhinoscopy. It is generally found in the olfactory cleft, but it may even pass around the lower margin of the middle turbinal and appear in the middle meatus, when it would have to be distinguished from pus originating in the frontal, ethmoidal, or maxillary cavities. In cases of doubt these latter cavities must be eliminated by the methods of exclusion already described. It would be well in the first instance to carefully cleanse the entire nose and postnasal space, and then to watch carefully for the reappearance of pus. If this is first visible in the olfactory cleft, and still more if it is seen on the roof of the choana and above, the diagnosis of suppuration in either the sphenoid cavity or posterior ethmoidal cells is almost assured. If, as often occurs in dealing with this cavity, the reappearance of pus is difficult to determine and there is any suspicion of its entry being made in the middle meatus, it is safest to make an exploratory puncture of the antrum. This will not only settle any doubt as to the presence or absence of pus in that cavity, but any reappearance shortly afterward of pus in the middle meatus would point to the anterior ethmoidal or frontal cavities. Of course, the detection of pus in these cavities would not invalidate its occurrence in the sphenoidal, but it would be wiser to assure their complete drainage before proceeding to deal with any remaining pus which must then come from the posterior group.

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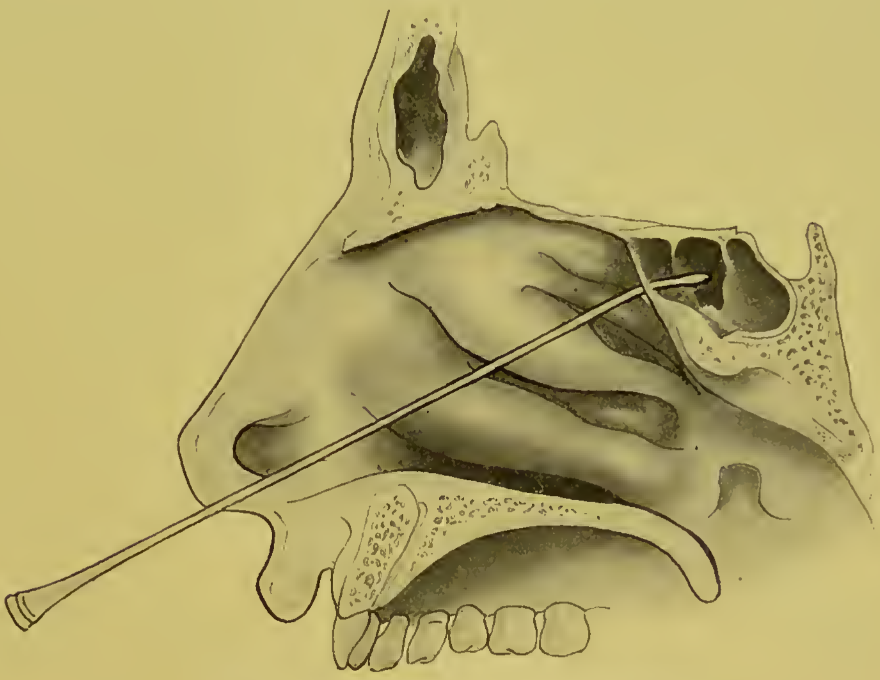
[1] A summary of 22 recorded cases of fatal intracranial complications following disease of the sphenoidal sinus will be found recorded by Zoubert in the Archives Générales de Médecine, October, 1900.

Mucous polypi are rarely met with in association with this form of sinusitis, but various forms of inflammatory hyperplasia are often found, particularly in the comparatively recent cases. In such cases, often with atrophy of the pharynx from the drying and irritation of the secretion passing backward, a chronic hypertrophy is sometimes encountered, particularly in the middle turbinal, which may seem larger than it really is in comparison with the atrophy which has often set in in the inferior turbinal. The middle turbinal may be so closely pressed against the septum that a sound is only passed after careful application of cocaine and adrenalin. If inserted in a sloping direction inward and upward diagonally across the plane of the middle turbinal it will impinge on the nasal surface of the sphenoid in the neighborhood of the ostium. (Fig. 509.) This opening has been found catheterizable in only 40 per cent. of cases. It lies

FIG. 509.



Method of catheterizing the sphenoidal sinus.

about 12 mm. above the posterior end of the middle turbinal, and close under the nasal roof.[1] In the majority of cases the opening lies a little external to the direction of the olfactory cleft (about 5 mm. from the middle line), and it is then impossible to pass a sound into the sinus without removal of the middle turbinal. This should be done as already described. If the anterior end has had the typical amputation performed then the remains should be removed with a cold wire snare, the punch forceps of Grünwald, or, under a general anæsthetic such as nitrous oxide gas, with the spokeshave.

According to Cholewa a view of the anterior wall of the sphenoidal sinus can be obtained, and the middle turbinal at the same time retained, by the following method: a slender elevator is introduced between the middle turbinal and the septum, and the former is pried outward and fractured, probably along its base of attachment.[2]

Even when free access has been obtained to the anterior sphenoidal wall the ostium is seldom distinctly visible, being generally closed by the folds of mucous membrane, much like the meatus urinarius. But, on carefully wiping and watching, the pus may be seen exuding from the region of the ostium. A catheter can, however, be passed into it by gentle manipulation, and the cavity should be syringed out. The nose having previously been carefully cleaned the exit of any pus will show that it comes from this cavity.

The distance from the anterior nares to the sphenoidal ostium varies between 2½ and 3¼ inches. The following are figures of different observers: Grünwald, in males 8.2 cm. (3¼ inches), in females 7.6 cm. (3 inches).[3] R. C. Myles, 2½ to 3¼ inches; to posterior wall of sinus, with probe bent a little, 4½ inches. Jonathan Wright, 2⅛ to 2½ inches (5.4 cm. to 6.7 cm.); in a living specimen he found the distance to the anterior wall to be 3 inches, and to the posterior wall 3½ inches.[4] Gleitsmann, 4 inches.[5] C. R. Holmes, from 5 cm. to 7.5 cm.; average, 6.18 cm.[6] Bosworth found that a probe impinging on the posterior wall of the sphenoidal sinus was 6¼ inches from the tip of the nose.[7]

My own experience is that the secretion which can be washed out in a chronic case is comparatively slight in amount and it is seldom pure pus. It is much more apt to be muco-pus, or even thick mucus with threads of pus in it, and I have remarked that it floats in the lotion used much like islets of frog's spawn in a pond.

But the catheterizing of the sinus has another value even in the case of a doubtful result from its lavage. It is this, that it determines positively the presence of a sinus and the justifiability of opening it up.

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[1] C. R. Holmes. Archives of Ophthalmology, 1896, vol. xxv. p. 461.

[2] Quoted by H. Cordes. Monats. für Ohrenheilk., May, 1899.

[3] Nasal Suppuration. London, 1901.

[4] Twentieth Century Practice of Medicine, 1896, vol. vi. p. 82, and Annals of Otology, February, 1902.

[5] New York Academy of Medicine. Journal of Laryngology, 1896, xi. p. 137.

[6] Archives of Ophthalmology, 1896, xxv. p. 461.

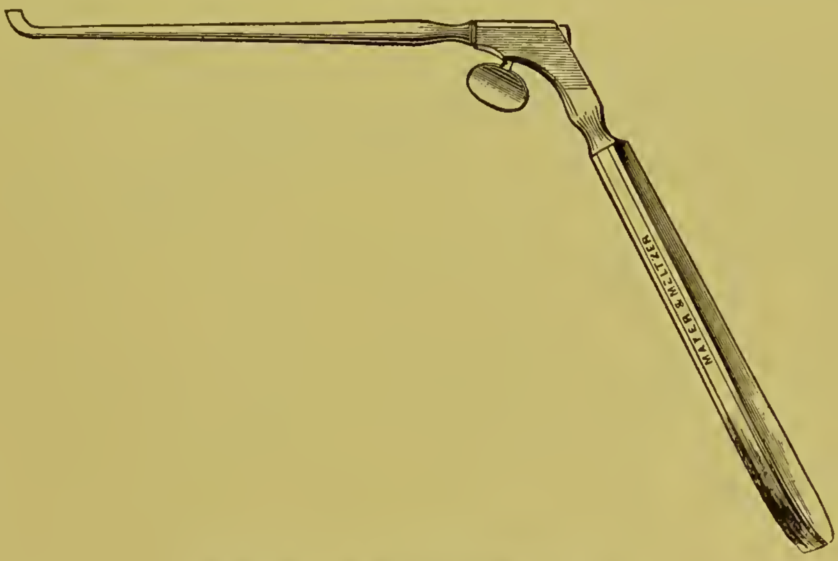
[7] Transactions of the American Laryngological Association, 1895, p. 94.

The sphenoidal sinuses are so irregular in contour, and their very presence sometimes so problematical, that it would be rash to attempt to break into a sinus without first determining that one is present.

Atrophy is a much more frequent result of prolonged sphenoidal suppuration, and not infrequently the nasal fossæ are so wide, and so filled with fetid crusts, that they present all the appearances of ozæna. It is in such cases that it is sometimes possible to explore the ostium without preliminary removal of the middle turbinal.

Treatment. In many cases where the ostium is not readily accessible, and in which the complaints of the patients are not very marked, he will be well advised to rest content with alleviative treatment. This will consist of symptomatic treatment to secure free drainage, and chiefly of regular cleansing of the nose and pharynx. This is best carried out with the postnasal syringe, or the anterior nasal syringe, using simply cleansing, tepid, alkaline lotions. When all crusts are expelled the nasal fossæ may be lubricated with some oily preparation such as simple liquid vaseline or benzoinol. The addition of any antiseptics is apt only to be irritating. The dryness of the pharynx may be relieved by a carbolic or other lozenge. In many cases, once the natural defensive power of the mucous membrane of the nose and cavum has been assisted by this treatment, it is often remarkable how the continuation of a sphenoidal suppuration can be tolerated.

FIG. 510.



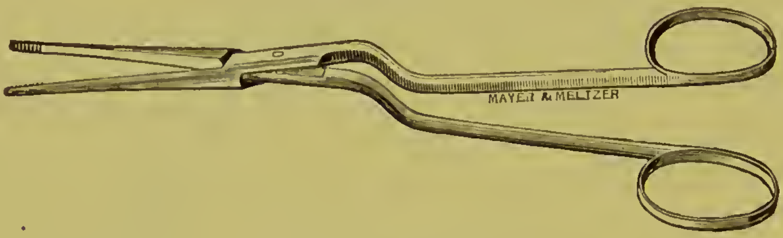
Hajek's hook for opening sphenoidal sinus.

Where more active measures are indicated access must be obtained to the ostium as already indicated, and the sinus must be regularly cleansed with alkaline and antiseptic lotions. If a freer exit is called for, the natural opening must be enlarged by inserting into it Hajek's sphenoidal hook and so tearing away part of the front wall. As soon as the margin is defined it can be further enlarged by the use of Grünwald's punch forceps.

Where there is difficulty in enlarging the natural ostium, and particularly where there is any softening or caries of the anterior wall, it can be penetrated with a trocar and canula below the level of the situation of the ostium, the opening being enlarged by curettes and sharp spoons.

I have found the following a simple and easy method of effecting an opening into the sinus. The patient is placed under a general anæsthetic and the forefinger, introduced through the mouth, is inserted into the choana of the affected side, as high up on the anterior sphenoidal wall as possible. A pair of blunt-pointed sinus forceps of special form (Fig. 511) are introduced through the nostril, and the point located just above the tip of the examining forefinger. With a little careful palpation a point can generally be found where with firm pressure the forceps will penetrate the anterior wall. As the instrument is withdrawn the blades of the forceps are expanded so as to enlarge the opening. On the following days this opening can be further enlarged under a local anæsthetic.

FIG. 511.



StClair Thomson's forceps.

It has been proposed by Jansen, and lately recommended by Furet and Luc,[1] to approach the sphenoidal sinus by traversing the maxillary cavity first. In that case a large opening in the canine fossa should be made as already directed, and then the nasal wall of the maxillary cavity should be freely removed in its posterior two-thirds. The anterior wall of the sphenoidal sinus then comes into the field of view opened out from the canine opening, and it is claimed that it can readily be dealt with. The extensive destruction of tissue entailed in this, the dangers associated with the proceeding, the more or less permanent disfigurement and discomfort of large unnatural permanent openings, and the still uncertain results obtained for what has not yet been proved to be such a frequently dangerous condition, prevent this operation from coming within the province of practical treatment. The possibility of reaching the cavity from the nasopharynx is neither practical nor useful.

When the sphenoid sinus is artificially opened, profuse hemorrhage has sometimes occurred. In a case of Gleitsmann's, the bleeding did not take place until seven days after the operation.[1]

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[1] Société Française de Laryngol., 1901.

The opened sinus must be dealt with according to the conditions met with. Necrosed portions of bone may require to be removed. Polypoid conditions of the mucous lining should be removed with forceps or curette, care being taken to respect the posterior wall. The condition of the mucous lining may be improved by plugging with iodoform gauze, or cleansing with iodoform emulsion. In many cases the cure is incomplete, and Grünwald has found that ozæna, traceable to suppuration in the sphenoidal sinus, is one of the most inveterate forms.

Indications for Treatment. Profuse postnasal purulent catarrh, persistent headache, orbital or intracranial symptoms, call at once for treatment. In their absence treatment must not only depend on the amount of suffering of the patient, but also on the skill of the surgeon.

Grünwald differs from many of less experience in thinking that the sphenoidal is one of the most satisfactory of the accessory cavities to treat.[2]

Mucocele. *Synonyms:* Chronic catarrhal sinusitis; serous sinusitis; cysts of the antrum; dropsy of the antrum; hydrops antri; hydrops inflammatarius.

Symptoms. It is difficult to prove that any increased flow of mucus or any serous discharge from the nostril originates in one of the accessory cavities. The source of such nasal hydrorrhœa may be suspected when, as in the case of a distinguished colleague, there is a sudden escape of about a teaspoonful of clear watery fluid from the higher nostril when one ear is lowered over the single wooden stethoscope. When the opposite ear is used no such flow occurs. Other possible symptoms are supra-orbital neuralgia, and occasional nasal obstruction, without any intranasal condition to explain it. Exploratory aspiration of the maxillary sinus will sometimes withdraw a clear, watery, sometimes amber-colored fluid.

In hydrops antri and in distended mucocele of the frontal sinus there is a gradual, painless distention of the cavity until the walls of the sinus are so thinned that under the finger they "crackle like strong parchment."[3] The swelling may reach the size of an orange. Sometimes the external wall is absorbed to such thinness that fluctuation is readily perceptible. The walls may yield so that when the maxillary sinus is affected the hard palate becomes flattened and the nostril blocked by the bulging of the nasomaxillary wall. When the frontal cavity is involved the orbit is seriously encroached on. When the contents of the sinus are removed they are found to consist of "inspissated mucus" (Ferguson), or clear or yellowish serous fluid, frequently containing cholesterine.

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[1] Transactions of the American Laryngological Association, 1895, p. 91.

[2] Nasal Suppuration. Lamb's translation. London, 1900.

[3] Sir William Ferguson. System of Practical Surgery, 1870, p. 597.

Pathology. The old view of this condition was that it was due to "catarrh" of the mucous membrane, and that when the exit of this secretion was obstructed it accumulated and distended the cavity. Although generally abandoned, this view has been recently supported by Noltenius, who reports 37 cases in which by exploratory aspiration he found serous exudation in the antrum where he thinks it was produced by "hydrops inflammatarius."[1] The mucous membrane, as has been pointed out, is indifferently supplied with glands, and has no vascular secreting arrangements like the nose. The mucus secreted by a catarrhal sinus amounts to very little. These "mucoceles" are much more likely to be caused by the development of cysts in the mucous membrane, either by the cystic dilatation of a gland or the cystic degeneration of a polypus. These cysts may grow to such a size that they occupy the sinus and are mistaken for its cavity. The cyst wall may rupture and the fluid become free. The walls are thin and the contents vary. As a rule it is a viscous liquid, thick, stringy, transparent and sometimes yellowish. In other cases it is opaque and even caseous. It frequently contains cholesterine. In large cysts it is more liquid, yellowish-white, sometimes transparent and syrupy in consistence, or stringy like white of egg. This pathology is supported by Christopher Heath,[2] who thinks that the term "dropsy of the antrum" should be abandoned, and Giraldes,[3] Virchow,[4] Wernher,[5] Alexander,[6] Scheppegrell,[7] and others object to the designation of hydrops antri as giving a false notion of the real pathological process, viz.: cystic dilatation. Grünwald says in relation to the frontal sinus, that the cases in which the secretion is purely mucous are "extraordinarily rare."[8] Luc describes a case of closed mucocele (passive) of the frontal sinus, the contents of which were typically cystic.[9] Cases in which this sinus are affected generally come under the ophthalmologist. Cystic dilatation of the ethmoid cells is dealt with elsewhere.

Treatment. This consists in opening and evacuating the affected cavity on the principles already described. There is no hesitation in recommending operative measures, for generally the disfigurement of the disease is worse than that left by the operation. There is not the same risk attending it, as pyogenic organisms are not present or only in insignificant number and virulence, and there is no need to make a counter-opening into the nose.

Tumors of the Accessory Sinuses. Growths in the accessory sinuses may be either simple or malignant. Among the former are œdematous fibromata (so-called myxomatous polypi), cysts, and osteomata.

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[1] Monats. f. Ohrenheilk., April, 1895, p. 114.

[2] Injuries and Diseases of the Jaw. Third edition, London, 1884.

[3] Recherches sur les Kystes muqueux du Sinus maxillaire. Paris, 1860.

[4] Berlin. klin. Wochenschrift, 1887, No. 13.

[5] Archiv f. klin. Chir., Band xix.

[6] Archiv f. Laryngol., 1897, Band vi., Heft 1, S. 130.

[7] Medical Record, August 26, 1899.

[8] Nasal Suppuration, p. 285.

[9] Annales des mal. de l'oreille, etc., 1899, xxv., No. 1, p. 395. See also W. E. Casselberry. Transactions of the American Laryngological Association, 1901.

The latter comprise sarcomata and epitheliomata. Neoplasms are not of common occurrence; they are more frequently met with in the maxillary than in the other accessory cavities.

Maxillary Sinus. Simple growths like polypi (œdematous fibromata) have already been referred to. Cysts of the antrum may be due to (1) obstruction and dilatation of the glands of the lining membrane; (2) cystic degeneration of polypi; (3) dentigerous cysts; (4) dental cysts. The two latter are not true antral cysts, but only invade it from without. Osteomata, fibromata, and true myxomata are rare (Jonathan Wright). Among the malignant growths may be mentioned epithelioma, carcinoma, and sarcoma.[1]

Frontal Sinus. Neoplasms are rarely met with in this cavity. Cysts, osteomata, and fibromata are the innocent growths which have been recorded. Carcinoma and sarcoma are very rare.

Ethmoid. The occurrence of polypi and cysts has already been dealt with. Osteomata are occasionally met with presenting at the inner angle of the orbit. Carcinoma and epithelioma are not uncommon in elderly subjects, and it is important to remember that sarcoma may occur as early as the ninth or even the fourth year (A. A. Bliss[2]).

Sphenoidal Sinus. Polypi are not common. Nasopharyngeal fibromata, sarcomata, and carcinomata are not infrequently met with, but generally invade the cavity from the outside.

Diagnosis. The age of the patient, the progressive character and constant pain, the occurrence of hemorrhage, the external manifestations, the secondary involvement of glands and neighboring tissues, as well as the application of the tests described, will help in determining the presence of a malignant growth. The simple ones, with the exception of the polypi and cysts already described, declare themselves by their slow growth and evolution.

Treatment. This has already been considered except in the case of the malignant growths. Early diagnosis of ethmoidal cancer will sometimes succeed in ensuring success by intranasal treatment only. Sarcomata are often slow-growing, and remain limited to the bony framework of the nose for some time after declaring themselves.

When originating in the maxillary cavity partial or complete resection of the upper jaw is generally required. In the other cavities operative treatment is almost hopeless.

Foreign Bodies. These have been incidentally referred to in the preceding pages. They are most frequently met with in the maxillary sinus.

Considerable help is given in the diagnosis and treatment of such foreign bodies as metal drainage-tubes, broken ends of instruments, and bullets, by the employment of the Roentgen rays.

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[1] Jonathan Wright. New York Medical Journal, November 4, 1893. Christopher Heath. Injuries and Diseases of the Jaws, London. Heymann. Virchow's Archiv, 1892, vol. cxxix. Bryan. Congress of Physicians and Surgeons, 1894.

[2] Transactions of the American Laryngological Association, 1896, p. 46.

APPENDIX.

THE following schema, as suggested by Dundas Grant, is founded on the method employed by Lermoyez of dividing the symptoms of sinus suppuration into presumptive, probable, and certain.[1] It must not be employed as if mathematically exact, but is useful as indicating the steps of a diagnosis.

TABLE I.

SIGNS OF A CHRONIC EMPYEMA IN ONE OF THE ACCESSORY CAVITIES OF THE NOSE.

PRESUMPTIVE:

- (*a*) Unilateral discharge.
- (*b*) Headache or neuralgia, relieved by discharge.
- (*c*) Subjective cacosmia.
- (*d*) Polypi, especially if bathed in pus.

PROBABLE:

- (*a*) Presence of pus in middle meatus or olfactory cleft.
- (*b*) Opacity on transillumination.

CERTAIN:

- (*a*) Catheterization of sinus through natural orifice, and expulsion of pus on irrigation.
- (*b*) Exploratory puncture of sinus, and aspiration of pus.
- (*c*) " " " expulsion of pus by air.
- (*d*) " " " expulsion of pus by irrigation.

TABLE II.

DIFFERENTIAL DIAGNOSIS ACCORDING TO THE SITE OF THE PURULENT DISCHARGE.

PUS IN MIDDLE MEATUS:

- Anterior cavities
  - Maxillary antrum.
  - Frontal sinus.
  - Anterior ethmoidal cells.

PUS IN OLFACTORY CLEFT:

- Posterior cavities.
  - Sphenoidal sinus.
  - Posterior ethmoidal cells.

TABLE III.

SIGNS OF SUPPURATION IN MAXILLARY ANTRUM.

PRESUMPTIVE:

- (*a*) Unilateral discharge.
- (*b*) Intermittence in discharge.
- (*c*) Pain—infra-orbital, supra-orbital, dental, or more distant.
- (*d*) Subjective cacosmia, intermittent.
- (*e*) Carious teeth.
- (*f*) Pus in middle meatus.
- (*g*) Polypi in middle meatus.
- (*h*) Hypertrophy in middle meatus.

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[1] Lermoyez. Therapeutique des maladies des fosses nasales. Paris, Octave Doin, 1896.

PROBABLE:

- (*a*) Reappearance of pus on cleansing middle meatus, and bending head forward (Fraenkel).
- (*b*) Transillumination showing opacity (Heryng).
- (*c*) " " obscurity of pupil (Davidsohn).
- (*d*) " " absence of subjective sensation of light.

CERTAIN:

Puncture and aspiration, transufflation, or irrigation, by—
- (*a*) Ostium maxillare.
- (*b*) Inferior meatus.
- (*c*) Alveolus.

TABLE IV.

SIGNS OF SUPPURATION IN THE FRONTAL SINUS

PRESUMPTIVE:

- (*a*) Continuous discharge.
- (*b*) Pain.
- (*c*) Tenderness on pressure.

PROBABLE:

- (*a*) No reappearance of pus on cleansing middle meatus and bending head forward.
- (*b*) Reappearance of pus after irrigating maxillary sinus.
- (*c*) Appearances on plugging the hiatus semilunaris.
- (*d*) Small quantity of pus, which does not crust.
- (*e*) Transillumination of maxillary sinus negative, and of frontal sinus positive.

CERTAIN:

Direct proof is impossible except by external operation.

TABLE V.

SIGNS OF SUPPURATION OF ANTERIOR ETHMOIDAL CELLS

(DISEASE OF MAXILLARY ANTRUM HAVING BEEN EXCLUDED).

PRESUMPTIVE:

- (*a*) Continuous discharge.
- (*b*) Pain.
- (*c*) Tenderness over lacrymal bone.
- (*d*) Mental depression.
- (*e*) Asthenopia.

PROBABLE:

- (*a*) Pus, with granulations or polypi, in middle meatus.
- (*b*) The use of a probe exposing pus or bare bone.

CERTAIN:

Exploration.

TABLE VI.

SIGNS OF SUPPURATION OF SPHENOIDAL SINUS.

PRESUMPTIVE:

- (*a*) Pain.
- (*b*) Ocular disturbance.
- (*c*) Somnolence.

PROBABLE:

Presence of pus (or crusts)—
- Anteriorly, in olfactory cleft.
- Posteriorly, on superior and middle turbinals, on roof of choanæ, and vault of nasopharynx.

Lesions in olfactory cleft—
- Bulging of wall of sinus in acute cases.
- Mucous polypi

CERTAIN:

(*a*) Pus seen flowing from ostium.
(*b*) Catheterization of sinus.
(*c*) Exploratory puncture.

TABLE VII.

Signs of Suppuration of Posterior Ethmoidal Cells.

PRESUMPTIVE:

As for sphenoidal sinus.

PROBABLE:

Polypoid middle turbinal.

CERTAIN:

Return of pus after irrigation of sphenoidal sinus.
Bare bone felt at posterior extremity of middle turbinal.

CHAPTER XXII.

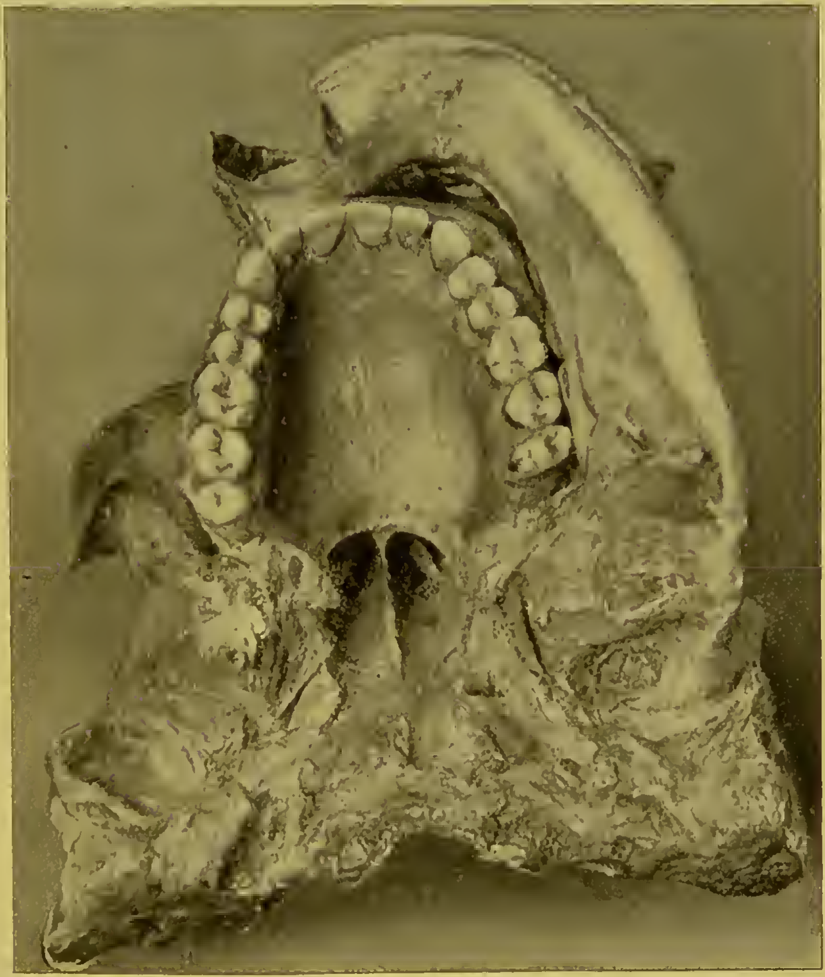
DISEASES OF THE OROPHARYNX AND NASOPHARYNX.

By H. S. BIRKETT, M.D.

SOFT PALATE AND UVULA.

Congenital Malformations of the Soft Palate and Uvula. Congenital absence of the soft palate and uvula is of rare occurrence. Accompanying is a photograph of such a condition. A second specimen of this malformation was lately found in the dissecting-room of McGill University.

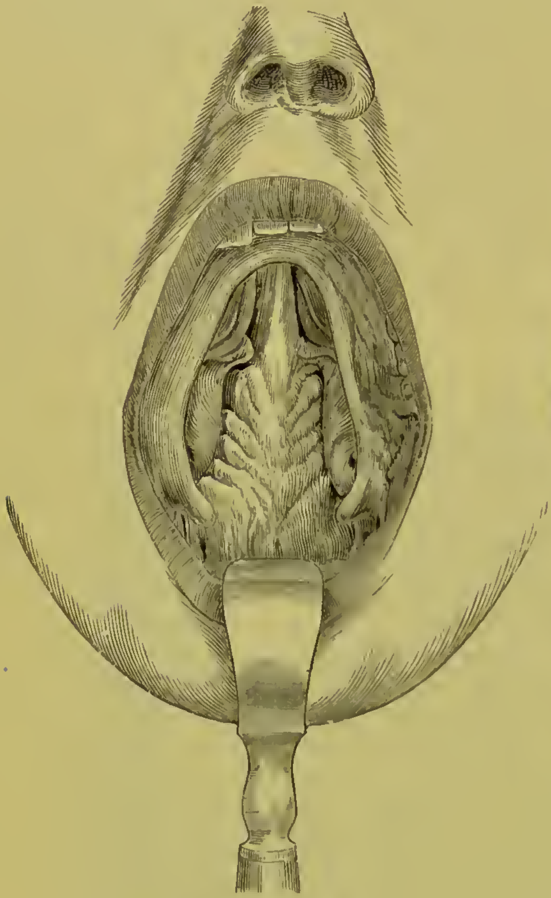
FIG. 512.



Congenital absence of soft palate and uvula. (From Professor Shepherd's Anatomical Museum, McGill University.)

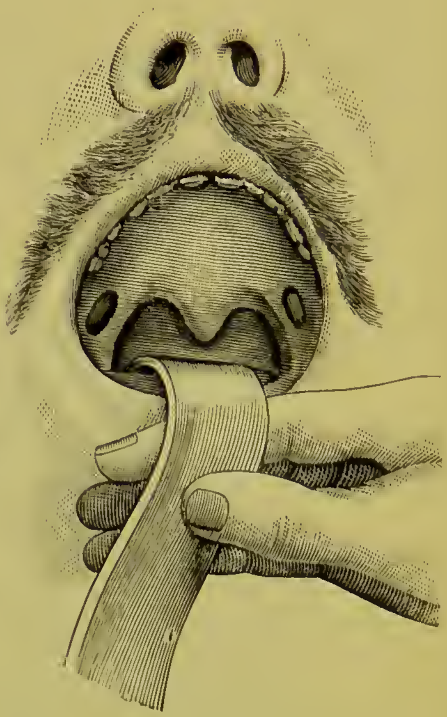
Another congenital condition of the soft palate and uvula is a want of fusion of the embryonic maxillary processes, giving rise to a condition known as *cleft palate* (complete). This want of union may vary in extent, and sometimes both hard and soft palate are involved in their entirety, as seen in Fig. 513. At other times it may only involve the soft palate and uvula, and again only the uvula itself may be affected, and in this latter case it gives rise to what is known as a *bifid* uvula. This division of the uvula may be partial or complete.

FIG. 513.



Cleft palate and uvula. (COHEN.)

FIG. 514.



Defects in the anterior pillar of the fauces.

Another congenital defect is occasionally met with in the pillars of the fauces. This defect consists of a perforation of either one or both anterior pillars. They may be congenital, due to an incomplete closure of the branchial clefts, or as the result of ulceration occurring in the course of an infectious fever (scarlet fever), as in one of the writer's cases, or as the result of breaking down of a gummatous infiltration.

DISEASES OF THE UVULA.

Uvulitis. Etiology. The usual cause of an acute inflammation of the uvula is "cold." It may also be the result of an extension of an acute inflammatory process from the adjacent structures (pharynx and tonsils). It may also occur traumatically through foreign bodies or from the action of any corrosive.

Symptoms. The first symptom usually noticed is a slightly painful sensation of the throat upon every movement of the soft palate, and especially marked when swallowing. Later on this is followed by a feeling of a foreign body in the throat, and every effort to dislodge it is apt to be followed by an intensity of the symptoms. Tickling and a cough are also apt to be present. The symptoms may become so aggravated as to actually precipitate attacks of suffocation due to the enlarged and elongated condition of the uvula irritating the upper part of the larynx. Upon examination in the early stage of the disease, the uvula is seen to be uniformly injected from its tip to its base, and from here extending slightly into the soft palate.

When exudation has taken place into the loose tissue of the uvula it then assumes a swollen, œdematous, and semitransparent look; its original outline and shape are completely altered. The general disturbance is usually very slight.

Treatment. In the early stage, before transudation has taken place, the application of a 5 per cent. solution of adrenalin chloride (1 : 1000), painted every hour, will frequently cut the inflammation short. If transudation has taken place, then the tension is best relieved by multiple punctures. This is best done by having the patient hold his tongue down himself by means of a depressor, then grasping the uvula at its tip to steady it, and with a long Graefe knife make several deep punctures into the most dependent portion of the uvula. The subsequent treatment is the use of an alkaline and antiseptic spray such as Dobell's solution.

In this connection may be mentioned *œdema of the uvula* occurring, although rarely, in the course of chronic Bright's disease, and that due to the result of patients suffering from postnasal catarrh who attempt to draw the secretion from the nasopharynx with such violence as to produce a traumatic œdema. Relief to local symptoms will be followed by puncturing the uvula as described.

Elongation of the Uvula. Causes. Recurring attacks of acute inflammation of this organ, chronic pharyngitis, nasopharyngitis, and want of general tone.

Symptoms. Frequent clearing of the throat, tickling followed by cough, especially aggravated when lying down, and in some cases the uvula has been so long as to reach the entrance to the larynx and produce a spasm of the glottis, the patient awakening with feelings of impending suffocation.

Treatment. Let one bear in mind that attention to the patient's general state of health is of primary importance, and combined with the use of astringent applications such as glycerin and tannic acid (B. P.), or 5 per cent. solution of protargol will serve in the majority of cases to relieve the symptoms. In the case of cough being a troublesome symptom, let one here be warned not to be deluded that the uvula may be the cause without first carefully investigating the patient's general condition as to the possible existence of other causes. The writer has frequently seen cases where a portion of the uvula has been removed with the expectation of relieving the cough, when, upon careful examination, the patient was found to be suffering from incipient tuberculosis.

When properly indicated a portion of the uvula may be removed as follows: The uvula, especially its posterior surface, is first painted with a 10 per cent. solution of cocaine, followed by an application of a solution of adrenalin chloride (1 : 1000). At the expiration of ten minutes the uvula is sufficiently anæsthetic to proceed. The patient holds his own tongue down to the floor of the mouth by means of a depressor, and the uvula, which has been grasped at its extreme tip by means of a pair of long angular forceps, then with a pair of long scissors, curved on the flat, the excessive length should be cut off in a direction from below backward and upward, thus leaving the greatest portion of the cut surface posteriorly. In cutting the uvula one must be careful to remove only the elongated mucous membrane, and not to injure the azygos uvulæ muscle. Complete ablation of the uvula is to be condemned as wholly unnecessary. The slight bleeding which usually follows a uvulotomy requires no attention, as it ceases in a short while; but it has occurred that the hemorrhage has been considerable, and when of such a degree, then the application of such a solution as adrenalin chloride (1 : 1000), glycerin, and tannic acid, or the application of the galvanocautery may be sufficient. If none of these measures arrest the hemorrhage, then the application of a ligature around the uvula and above the cut surface will suffice.

The subsequent treatment of a case of uvulotomy is rest of the organ, and this means abstaining from speaking and of taking nourishment in such a form as to require the least amount of swallowing consistent with the greatest amount of nourishment; therefore, such foods as jellied beef essence, calves' foot jelly, and oysters are the best form of nourishment. The pain following a uvulotomy is considerable, and will be relieved by the use of small pieces of ice being held in the mouth while reclining.

Hæmatoma of the uvula is not infrequently seen as the result of operative interference on the organ itself or as a sequence of tonsillotomy. The writer has also seen it as the result of violent efforts of nasal screatus. A varicosity of the superficial bloodvessels of the soft palate and uvula may occasionally be seen in cases of arteriosclerosis.

Benign and Malignant Growths of the Uvula and Soft Palate.

Benign Growths. Papilloma. This is the most frequent of the benign growths occurring in this region. Papillomata may be either sessile or pedunculated, and distributed in groups or singly on any part of the soft palate, uvula, and pillars of the fauces. When sessile and single they cause no symptoms, but when agminated or pedunculated they may produce symptoms of a foreign body, as tickling cough or frequent clearing of the throat.

Angioma. Angiomata are rare and sometimes found to be associated with a similar condition in the other portions of the respiratory tract. These tumors may be single or consist of a series of small ones scattered over the palate and uvula. In one of the writer's cases the tumors were scattered over the soft palate and cheek of one side, but in the larynx they were collected into a very definite tumor involving the false cord on the same side.

They seldom cause any symptoms or require any interference; but if large and they tend to be a source of recurring hemorrhages, then they are best treated by means of electrolysis, although there are many who advocate their removal by either the cold or galvano-cautery snare.

Simple adenoma of the soft palate is rare, more commonly such tumors being mixed, as fibro-adenoma or myxo-adenoma. These tumors are usually sessile or pedunculated and covered with normal mucous membrane, and do not tend to invade the surrounding structures. Their presence is not attended by any painful sensations, but usually those of a foreign body in the throat. Removal by means of the cold wire snare or by scissors are the best ways of dealing with them.

The following rare benign tumors may also be met with in this region: *dermoid cysts, lipomata, fibro-chondromata,* and *echinococcus cysts.*

Malignant Growths. Malignant tumors originating in either the soft palate or uvula are not of frequent occurrence, but, as an extension of the disease from neighboring structures, are not uncommon.

Carcinoma. Carcinoma of the soft palate usually appears in the form of epithelioma. The disease shows itself in any portion of the uvula or soft palate, and in the early stage makes itself known by a definite swelling of the part invaded; the mucous membrane covering it is slightly injected. To the touch it is firm and the overlying structures intimately adherent. There is gradual enlargement until the surface is broken and an ulcerating surface presented, the granulations of which are intensely red, bleed easily, and the edges firm.

Symptoms. In the early stage the symptoms are those of impaired movements of deglutition and speech. The pain may not be severe until ulceration takes place, when it is apt to be severe, especially during the process of deglutition, the pain radiating toward each ear should the growth be situated in the uvula alone or in the centre of the soft palate; but if to one side of the middle line, then the pain shoots into the ear on the corresponding side. It is a disease usually of advanced age.

Sarcoma. Sarcoma of these structures is rare, the most common variety being the fibroid; less common are lymphoma and the melanotic variety. Sarcoma may in its early existence present a swelling of the invaded structures not unlike carcinoma; but the mucous membrane covering it is not so hyperæmic. Its course is slower than that of carcinoma, and the lymphatic glands are frequently not involved. It is a disease found much earlier in life than is carcinoma.

Symptoms. The symptoms may in every respect resemble those of carcinoma.

Treatment. Judgment in operating upon all malignant cases in which the soft palate and uvula are primarily involved must be treated according to individual conditions present. When the disease is well limited to either the uvula or soft palate complete removal is to be strongly advised. Any glandular involvement will also require removal by surgical measures. In the treatment of sarcomata the use of Coley's serum has found many strong supporters, and it is only one of those measures which are advocated when surgical measures seem to be out of the question.

DISEASES OF THE TONSILS.

The tonsil is a collection of lymphoid tissue upon whose free surface are a number of depressions (crypts or lacunæ), separated from each other by follicles, and is covered by a mucous membrane which dips into these crypts. Depending upon the situation of this collection the tonsils have received various names—faucial, pharyngeal, and lingual.

The faucial tonsils are two in number, one on either side, between the anterior and posterior pillars of the fauces. In size and shape they may vary very much in different individuals; ordinarily they are about the size and shape of an almond fruit. If, when inspecting the faucial tonsil, the anterior pillar is drawn forward, outward, and slightly downward, a fold of mucous membrane will be seen extending from its edge downward and backward to the tonsil. This is known as the *plica triangularis* (His). Immediately above this is a recess or fossa to which the name *supratonsillar fossa* has been given, and this recess is found to extend backward and sometimes forward into the substance of the soft palate.

Acute Catarrhal Tonsillitis. In this affection the mucous membrane covering the tonsil is the part chiefly affected, and is nearly always a part of an acute pharyngitis.

Etiology. This disease is most common in children. Sudden changes in the temperature and exposure to cold, gastro-intestinal affections and many of the acute exanthemata.

Symptoms. The symptoms may be ushered in by a sense of chilliness, and in young children even by a convulsion. This is accompanied by headache, general depression, temperature ranging from 100° to 102°; pulse full and bounding, deglutition is painful, and the muscles of the neck and the cervical glands may be tender. Upon examination in the early stage of the disease the surface of the tonsil and surrounding structures present a marked degree of hyperæmia, and later on a very thin, whitish exudate may be seen at the openings of the crypts. The disease usually runs its course in about four days if unattended to, and may by its extension involve the middle ear in an acute inflammatory process, attended either with or without suppuration.

Treatment. Begin with a purgative, such as calomel and soda in small doses, gr. j each, frequently repeated. If the temperature be high and the pulse full and bounding, small doses of tincture of aconite (B. P.), ♏ij every two hours, will be of service. Cold alkaline sprays such as the following will be found to give relief to the symptoms in the early stage of the disease:

Sodii bicarbonatis,	
Sodii biboratis,	āā gr. xx.
Ol. cinnamomi,	♏ij.
Aquæ,	℥iv.

Applications of a solution of nitrate of silver (gr. xxx to ℥j) once a day, or guaiacol in its pure state, to the surface of the tonsil and into the crypts, are strongly recommended. Should the disease progress to such a degree that the inflammatory process shows by its intensity that the underlying structures have been invaded, then local depletion (scarification) is advisable. The spray then, or gargle, should be used hot.

Acute Lacunar Tonsillitis. This affection is an inflammation of the crypts or lacunæ of the tonsils, and is characterized by the filling-up of these crypts with inflammatory products, which appear on the surface as a white or yellowish-white exudate, accompanied by an involvement of the adjacent and deeper-lying structures in the inflammatory process.

Etiology. Among predisposing causes a lowered state of the general system stands pre-eminently first. Sudden changes in the temperature, unhealthy condition of the tonsils themselves, and as exciting causes, in the light of present bacteriology, certain bacteria, notably the pyogenic cocci, are found to be the cause of such inflammatory conditions. Other exciting causes, as imperfect sanitation, close, overheated, and foul atmosphere, so frequently met with in the outdoor clinics of many large hospitals, give rise to this condition, and is generally known as "hospital sore-throat." This disease is more common in young and middle-aged individuals, and less frequent in advanced life. It is not uncommon to find this form of tonsillitis attacking individuals in a house where scarlet fever is present. One attack is apt to predispose to future attacks.

Symptoms. The disease is usually ushered in by headache, pain in the back or extremities, chilliness or even rigor. The throat is painful, especially when swallowing, and even speaking may be painful. The pain extends upward to the ears if both sides are involved, and to one, on the same side as the affection, if limited to one tonsil. The temperature varies from 100° to 103° or 104°; the pulse is rapid (100–120), full and bounding. Usually, the disease begins on one side, and within a time, varying from a few hours to a day, the other side is invaded. The submaxillary glands are frequently swollen and tender. The inflammatory condition may extend to the parenchyma of the tonsil, when the symptoms become somewhat more intensified (parenchymatous tonsillitis). Upon examination the tonsils are seen to be swollen and hyperæmic, and if the parenchyma is involved the hyperæmia may be of a livid hue. On the surface of each tonsil are to be noticed small isolated spots of exudation, their size and shape corresponding very often to the opening of the crypts. This exudated material varies in color; it may be white, yellow, or gray. The exudation may be limited to the openings of the crypts or may extend and coalesce with that from the neighboring crypts, giving to it in some cases a distinctly membranous appearance. The exudation may be so slightly organized that it may be easily wiped off by means of a cotton-wool swab, or it may be so dense as to be adherent to the mucous membrane, and require the use of a pair of forceps to loosen it, and when loosened it exposes an underlying, very hyperæmic, and even superficially ulcerated area.

In persons who have suffered from recurring attacks of acute lacunar tonsillitis the secretion is apt to have a very fetid odor. The uvula is usually hyperæmic and sometimes swollen.

Treatment. A brisk purgative of calomel and soda should be given at the outset, about gr. iv of calomel and gr. iij of soda. Small doses of tincture of aconite (B. P.), ♏ij, may be given hourly until the pulse and temperature are lowered, provided, of course, that the pulse is a rapid, full, and bounding one. The salicylates in various forms have in some cases proved advantageous; salol gr. v and phenacetin gr. iij, given every two hours in combination, have, in the writer's hands, proved most beneficial. Guaiacum, a much vaunted remedy, has not, in the writer's experience, proved to be especially efficacious. Benzoate of soda in 10-grain doses is warmly advocated by many authors. Locally, the tonsils should be sprayed with a warm alkaline and antiseptic solution, such as one of the following:

1.	Acidi carbolici, (Calvert's No. 1)	gr. j.
	Sodii bicarbonatis,	gr. v.
	Aquæ,	℥j.
2.	Sodii bicarbonatis,	gr. v.
	Listerine,	ʒj.
	Aquæ,	℥j.

Whenever possible it is advisable to clear out the crypts of any retained secretion, and this can be done by means of a small curette or scoop. Another method of dislodging these inflammatory plugs which the writer has found beneficial is to project against the tonsil by means of a syringe a stream of warm boric-acid solution (gr. xx to ℥j). In carrying this out it is necessary to have the patient leaning a little forward, and thus facilitate the escape of the fluid by the mouth. The application of either guaiacol, the muriated tincture of iron, or tincture of iodine, by means of a cotton-wool swab, into each crypt will tend to cut short the course of the disease in many cases. If impossible to make these applications, then these remedies may be used in the form of gargles; thus guaiacol should be used as a 1 per cent. solution, the tincture of iodine in the same strength, and the muriated tincture of iron in doses of ♏v combined with gr. iv of chlorate of potassium to the drachm will be found efficacious.

As to a choice of any of the above-mentioned remedies as a local application there does not seem to be one, in the writer's experience, each drug having its own adherent. As there is in all probability an infectious character about these acute inflammatory processes of the tonsil, such cases should as a precautionary measure be isolated. In houses where there is a frequent occurrence of these attacks, investigations should be made into the conditions of the drains and sanitary surroundings; in all cases a cause should be looked for, and, if possible, be removed. Any existing diathesis, as rheumatism or gout, should be corrected by suitable remedies. The course of the disease is usually favorable, terminating in recovery in about four or five days. Complications of a more or less grave character are rarely met with, and when they do occur, they indicate a general infection. The occurrence of joint affections and cardiac complications has led to the supposition of a very close association between rheumatism and tonsillitis.

Tonsillar and Peritonsillar Abscess. Depending upon the situation of the accumulation of the inflammatory products, so is the affection named. In the one, the suppurative process is situated in the substance of the tonsil, and in the other, in the tissue surrounding it. The former affection is comparatively rare and the latter quite frequent. Peritonsillar abscess may occur at any age, but is especially associated with adolescence and a strumous habit.

Etiology. Acute lacunar tonsillitis is apt to be a precursor of either tonsillar or peritonsillar abscess, chronically enlarged tonsils, retention of secretion within the crypts, especially in the supratonsillar fossa.

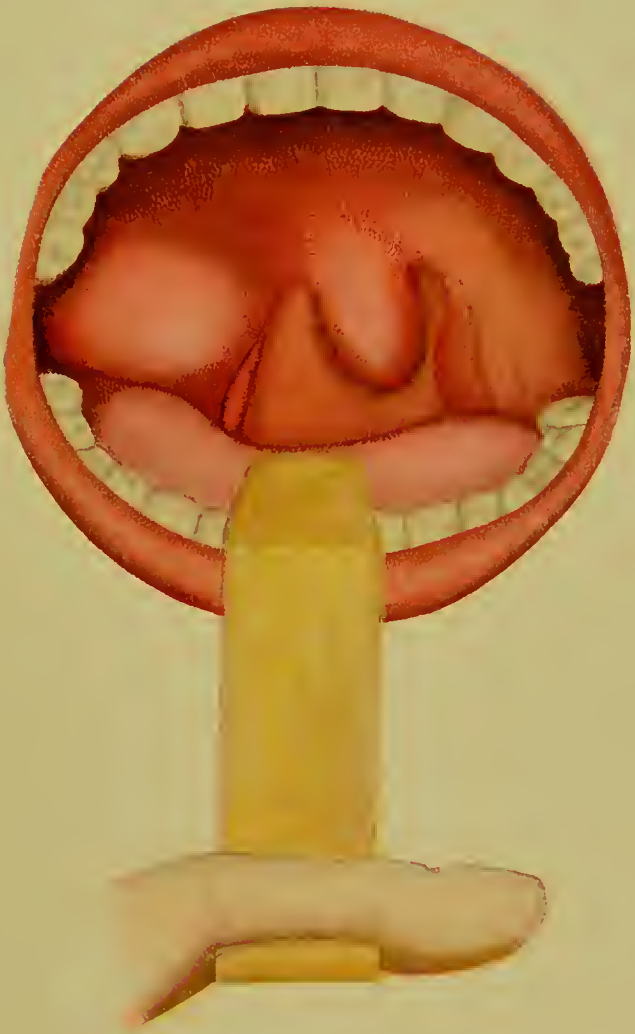
Symptoms. The symptoms are those of an acute lacunar tonsillitis, although they are apt to be more intense; deglutition is more difficult and more painful; the pain in the ear is apt to be more constant from the swelling of the soft palate, extending often up to the mouth of the Eustachian tube. There is marked difficulty in opening the mouth, the opening being so limited in severe cases that a thin tongue-depressor is with difficulty inserted between the teeth. The secretion of saliva is much increased, and with the other glandular secretions it becomes very tenacious and difficult for the patient to get rid of; in fact, attempts at its removal are so painful that many patients allow it to dribble out. The breath usually is very fetid, and especially is this so when suppuration has occurred. The temperature at this stage is apt to be more elevated (101° to 102°); the patient's voice becomes very thick, speech is with difficulty carried out, and, on account of its character, difficult to understand. There is often obstructed breathing through the nostrils on the affected side, and the patient has a sense of fulness at the back of the nostril, and frequently tries to clear it by making a snorting noise. This obstruction is due to a swelling of the upper surface of the soft palate posteriorly. There is a marked tenderness of the submaxillary and cervical glands, and there is often a marked fulness behind the angle of the lower jaw. From the inability of the patient to take nourishment there is loss of weight, and the facial expression is that of acute suffering. The examination in many cases is carried out with a great deal of difficulty, owing to the inability of the patient to open his mouth sufficiently wide to make the examination thorough. In those cases which allow the examination to be made it is noticed that there is a definite and distinct swelling in the soft palate just above the tonsil of the affected side. (Plate XXIX.)

The mucous membrane covering it is of varying intensity of color, from either a rose to a livid hue. The tonsil itself is pushed inward and downward, and to such an extent in severe cases that its inner surface looks directly over the epiglottis. The uvula is swollen, œdematous, and pushed beyond the median line, and sometimes in contact with the tonsil of the opposite side. If it is possible to examine the swelling digitally there is a full, tense, and deep fluctuating sensation to be felt.

Treatment. If the patient be seen in the inflammatory stage, before suppuration has taken place, there is nothing better, in the writer's experience, than a deep, free incision into the substance of the soft palate, just a quarter of an inch above the anterior palatine arch, and made at right angles to it. This gives relief to the tension and allows of the free escape of accumulated inflammatory products, and the local depletion adds very much to the relief of the symptoms. No therapeutic measures seem to relieve this condition. Should the stage of suppuration be present when the patient is seen then the pus should be allowed to escape by means of an incision made as above described. In either case the kind of knife and its method of use are of some considerable importance.

The use of a curved bistoury is not advisable, because it is impossible to tell where the point of the instrument may be; preferably, a straight back, narrow-bladed knife is the better. The knife should be held with its blade horizontal, and the cutting edge directed toward the middle line. By making the incision in this way its edges are more likely to be kept apart, and thus facilitate the escape of pus, than if made vertically, when the edges come together and close the wound. The pus which escapes has usually a very fetid odor. Pressure on the region of the abscess will facilitate the contents being thoroughly evacuated. The subsequent treatment is merely the use of an anti-

PLATE XXIX.



Peritonsillar Abscess. (Author's case.)

septic gargle of listerine (1 drachm to the ounce), or a weak (2 per cent.) carbolic solution. Leland strongly advocates the reaching of these abscesses through a very free incision made into the substance of the tonsil, and subsequently using the finger to enlarge the opening. In several of this class of cases the writer has found the suppurative process to have been caused by caseous products retained in the supratonsillar fossa, and by simply drawing the anterior pillar of the fauces forward and downward by means of a bent probe the collection of pus has been allowed to escape, with relief to the symptoms and without further operative interference. It is therefore always well to investigate the possibility of the pus being thus retained before proceeding to incise. Upon recovery this pocket can be dealt with by providing free drainage and curetting the cavity.

The duration of this affection if left to itself is usually from five to seven days. The danger, however, of allowing a collection of this kind to go on until the pus finds an exit for itself is that it may escape during sleep, and produce alarming symptoms, if not suffocation itself. If the pus has burrowed very extensively it may erode the ascending pharyngeal or internal carotid artery, producing alarming or even fatal hemorrhage. Septic thrombophlebitis is also known to occur, and is generally a fatal complication. The inflammatory condition may extend downward and produce an œdema of the larynx. Usually only one side is involved in tonsillar or peritonsillar abscess, but the process may occur in both sides.

Acute Ulcerative Tonsillitis. This is the title of an affection of the tonsils given by Moure to a condition seldom met with, and characterized by the occurrence of ulcerations involving only the superficial structures of the tonsil. It is benign in its nature, although the healing process is slow. The ulcers may appear either single or multiple on any portion of the tonsil. The affected area is covered with a grayish-white exudate, and on removal, which is easily done without bleeding, it exposes an underlying superficially ulcerated surface, the edges of which are clearly defined and not indurated; the surrounding area of the ulcer is much inflamed.

The symptoms are those of a mild, acute lacunar inflammation, and the treatment consists of the frequent (every two hours) use of an alkaline and antiseptic spray, such as Dobell's solution. The daily application of a weak solution of silver nitrate (1 per cent.) will stimulate the ulcer to heal. The affection may possibly be mistaken for malignant ulceration or primary syphilitic infection. Careful examination, however, into the clinical history of the case will lead to a definite diagnosis.

Membranous Anginæ (Non-diphtherial). Under this heading is included several forms of angina characterized by a membrane involving either the tonsils, soft palate, or posterior wall of the pharynx, separately or collectively. The condition is an infectious one, and may be due to any of the following bacteria: staphylococcus, streptococcus, the bacillus of Freidländer, pneumococcus, the bacillus coli, and the fusiform bacillus of Vincent. The membrane, which is deposited in the various locations just mentioned, is either whitish or yellowish in color, and in thickness varies from a thin pellicle to one of considerable degree and toughness, but never attaining that thickness and toughness characteristic of diphtheria. It is fairly adherent to the underlying mucous membrane, and when removed leaves a bleeding and, in some cases, an ulcerated surface. The constitutional disturbance is usually slight; but in some cases, especially the streptococcal, staphylococcal, and pneumococcal infection, it may be marked, the temperature rising to 101° or even to 104°. The pulse under such conditions is rapid and full, and the submaxillary glands swollen and tender; there is slight pain on deglutition, increased salivation, and even a fetid breath. There is usually very little general depression, even in the more severe forms, and in this respect differs so markedly from diphtheria. The course of the disease varies. In the form due to staphylococci and streptococci its duration is from five to seven days, but when due to the presence of the other mentioned bacilli, it may be from one to four weeks before the membrane has entirely disappeared.

Clinically, its appearance resembles closely diphtheria or syphilis, but bacteriological examination will clear up any doubts as regards the former, and the personal history and antisyphilitic treatment will correct any doubt as regards the latter.

The treatment consists in the use of antiseptic sprays or gargles, such as a solution of boric acid (gr. xxv to ℥ij), bichloride of mercury solution (1:10,000), antifebrile mixtures, when indicated, and subsequently general tonic treatment.

Hypertrophy of the Tonsils. This is a condition which may be found in all ages, from the youngest infant to the oldest adult. It is usually an evidence of a strumous diathesis, and is in many cases hereditary. Several local conditions are apt to lead to a chronic hypertrophy of the tonsil, and especially in those tonsils where there are recurring attacks of tonsillitis due to diseased conditions of the crypts (retention of secretion, chronic lacunar tonsillitis, tonsillar and peritonsillar abscess). Mouth-breathing dependent upon nasal obstruction, all inflammatory affections of the throat—whether due to local or systemic causes (infectious fevers)—will produce chronic enlargement of the tonsils. In young individuals the condition is usually associated with the existence of enlargement of the pharyngeal tonsils (adenoids); but in older individuals this is not always the case, the strumous condition having apparently centred itself in the enlargement of the faucial tonsils alone. Two types of enlarged tonsils are usually recognized, the one which is soft and lymphoid in character, and the second, which is firm or fibroid. The former is usually the one found in young children and the latter in adult life.

Symptoms. When the tonsils are considerably enlarged they produce mouth-breathing, thick speech, and frequently cough when the patient is lying down, through the lower part of the tonsil being sufficiently enlarged as to irritate the upper part of the epiglottis. In lesser degrees of hypertrophy there may be no symptoms or inconvenience. One must always have in mind that the above-mentioned symptoms, especially in children, are apt to be associated with an enlargement of the pharyngeal tonsil (adenoids). In adults, the presence of enlarged tonsils is apt to produce fatigue of the voice, either in speaking or vocalizing. Frequently, patients complain of noticing white spots on the tonsil, and upon manipulation of the tonsil itself these spots are extruded in the form and shape of a small pea which, when crushed, produce a very disagreeable odor. The effect on the hearing is indirect and largely due to the interference with the action of the palatal muscles, and not to direct pressure upon the opening of the Eustachian tubes.

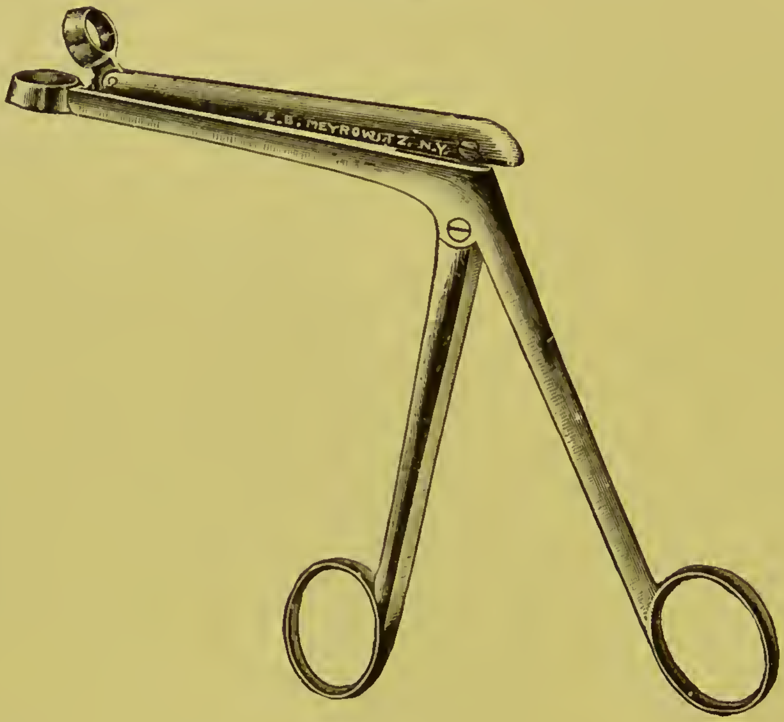
Upon examination, the tonsil may be found enlarged to various degrees, from just beyond the edges of the pillars of the fauces to meeting each other in the median line. The tonsil in the lymphoid variety is usually soft, of a pale rose color, and the surface smooth. In the fibroid variety it is hard, paler in color than the other variety; the surface irregularly divided by bands of fibrous tissue, and the crypts widely open and sometimes filled with caseous plugs. The enlargement of either variety may be either in the antero-posterior or vertical plane. Pynchon has given the name "submerged" to that condition of the tonsil which is hidden by a large hypertrophied fold of the anterior pillar spreading over the tonsil. Sometimes the anterior and even posterior pillar may be adherent to the hypertrophied mass, and this condition may be easily overlooked if not carefully investigated by means of a bent probe, whereby the anterior pillar of the fauces may be drawn forward, and thus allow of a more careful examination. Sometimes it happens that the mouths of the crypts being closed, we have then a condition produced known as a "retention cyst," which shows itself as a white or yellowish-white spot covered by thin mucous membrane. In size, they may vary from that of a pin's head to that of a large-sized pea.

Treatment. Before beginning treatment for hypertrophy of the tonsil, one must ask the question, Does the case call for treatment? and, based upon this, must the case be dealt with. It frequently happens that patients present themselves with enlarged tonsils, in whom they produce no symptoms at all, and simply because they are enlarged is their reason for having them removed. Only, then, if there are tangible symptoms referable to the enlargement of the tonsil, is interference called for. Each case must be dealt with upon its own merit and the treatment best adapted for the relief of the symptoms carried out. Local medicinal treatment is, in the majority of cases, useless. When, however, the cause of recurring attacks of tonsillitis is due to the retention of caseous plugs within the lacunæ, and the tonsil itself is not enlarged, it sometimes is of use to clear out these crypts of their contents and apply the following application:

Iodini,	gr. x.
Pot. iod.,	gr. iij.
Glycerini pur.,	℥j.

or solid nitrate of silver fused on the end of the probe. These measures may be used in patients who will not submit to more radical treatment; but what may appear to the patient to be a less formidable measure than removal is the following: Thoroughly opening all the crypts by means of scissors or a suitably curved knife, and of cutting through every band of tissue which serves to partially divide the crypts from one another, and then applying either solid nitrate of silver or the galvanic electrode to the floor of the spaces thus opened up. A better result is often obtained by using a pair of punch forceps (Farlow's, Fig. 515), and directly removing piecemeal the offending portions of the tonsil. Especially is this method of use in those tonsils in which this condition (retained secretion within crypts) exists and are well retracted within the fauces, and difficult to get at by other means. In such cases it will require the use of a tenaculum to draw the tonsil up from its bed into the field of operation. This method of treatment (morcellement) will also be found useful in freeing the supratonsillar fossa of tissue which dams up any secretion, and thus allowing better access to treat the pocket in the fossa, which so frequently retains secretion. This pocket when thoroughly exposed and drained is best treated by the application of solid nitrate of silver, the galvanocautery point, or the use of the curette.

FIG. 515.



Punch forceps.

Often upon examination the openings of these crypts are not readily seen and require one to carefully examine the tonsil by means of a probe whose end is bent at right angles. By means of this, bands of fibrous tissue may be drawn to one side, revealing filled crypts, and especially should the anterior pillar of the fauces be drawn forward and the underlying portion of the tonsil carefully examined. In all these operative procedures the part to be operated upon should be swabbed over with a 15 per cent. solution of cocaine; the anæsthetic action will be present in about ten minutes after its application. The subsequent application of a solution of adrenalin chloride (1:1000) will moderate the bleeding.

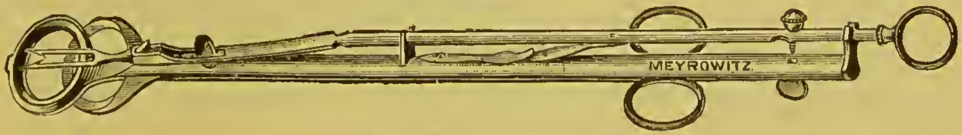
When the tonsils are so enlarged as to require reduction in size, then there are several means at one's disposal. These are:

1. Guillotine.
2. Cold wire snare.
3. Electric wire snare or electric guillotine.
4. Enucleation.

In the selection of one of these measures one must be guided by the condition of the tonsil. In the soft variety, occurring chiefly in children, the guillotine should be selected; but in cases of the fibroid or hard variety of tonsil, then the cold wire snare or the electric current, as applied to the snare or guillotine. The reason for thus laying down very definitely such a rule is that in the soft variety, which largely occurs in children, bleeding is more likely to be only moderate, and ceases readily of its own accord, while in the fibroid variety the bloodvessels do not retract so readily into the remaining substance of the tonsils, and the result is that there is a greater tendency to not only primary, but secondary hemorrhage.

1. GUILLOTINE. Tonsillotomy in children up to fifteen years of age should be done with the patient under a general anæsthetic, for, as a rule, enlarged tonsils are associated with adenoids, which also should be removed at the same time. When sufficiently under the influence of the anæsthetic the patient is gently raised to the upright position, the mouth-gag inserted, then, by means of a head-mirror, the tonsils are illuminated by reflected light, and the guillotine, either Mathieu's (Fig. 516) or Mackenzie's modification of Physick's (Fig. 517), is held in the left hand when removing the patient's right tonsil, and in the right hand when removing the patient's left tonsil. The instrument is now made to engage the tonsil in the ring, and this is done by encircling the gland from below upward. In this movement the ring of the guillotine must be held almost horizontally, thus

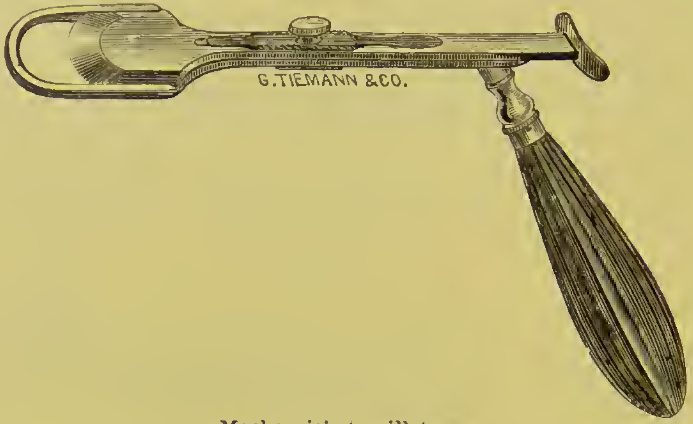
FIG. 516.



Mathieu's tonsillotome.

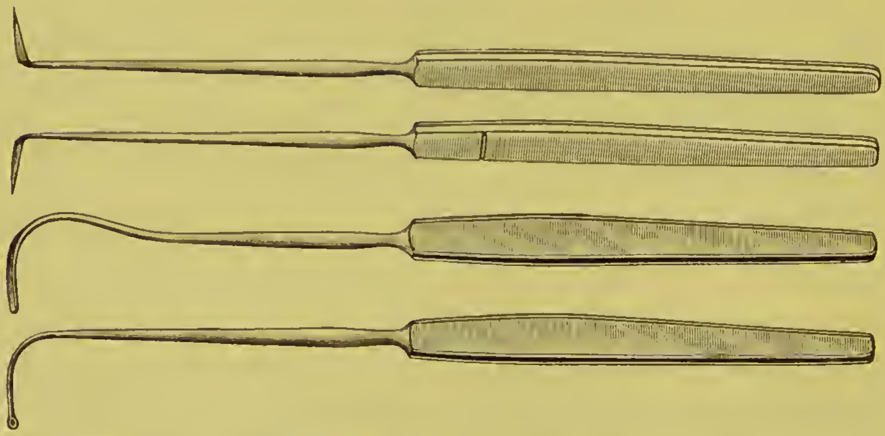
allowing of the most dependent portion of the tonsil to become first engaged; then by bringing the ring into the vertical position the remainder of the tonsil will be engaged. Before abscising the engaged portion it is well to examine with the index finger of the disengaged hand and ascertain whether all that can be engaged is well within the ring of the guillotine. The engagement of the tonsil may sometimes be facilitated by pressing on the gland underneath the angle of the jaw. In case one is using the Mackenzie instrument, the blade is now pushed home and the portion of the tonsil removed. In using the Mathieu instrument the fork is only thrust into the substance of the tonsil when it is well engaged, and the cutting blade is then drawn toward one. This latter instrument is of use when the tonsil lies fairly well retracted, for by use of the fork it is drawn out of its bed, and also the amount of the gland to be removed is regulated. In many cases where the tonsil is very dependent at its lower portion, if this be not properly engaged, the very object of its being removed

FIG. 517.



Mackenzie's tonsillotome.

FIG. 518.



Instruments for freeing adhesions between the pillars of the fauces and tonsils. (MAKUEN.)

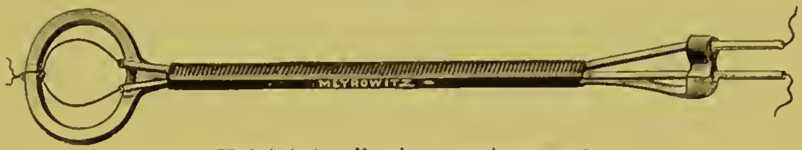
may be defeated, for in such cases the tonsil is usually a source of irritation to the structures near the tip of the epiglottis, and its presence produces a disturbing and annoying cough.

Before doing a tonsillotomy be sure that there are no adhesions between the pillars of the fauces and the tonsil itself. When present, and it is chiefly among adult cases that such a condition exists, they are best freed by the use of such an instrument as indicated in Fig. 518. By thus freeing the tonsil it is more readily engaged, and there is also a lessened danger of cutting the anterior pillar.

2. Cold Wire Snare. The ordinary nasal snare with a regulating screw is the instrument used. The instrument requires to be *very strongly* made, and rather stout piano wire (No. 10) should be used. The loop is made of just sufficiently large size to engage the tonsil, and when engaged it is made taut and slowly screwed home, about three to five minutes being occupied with cutting it through.

3. Electricity as Applied to the Wire Snare or Guillotine. The best means of using the electric wire snare is that known as Knight's electric tonsil snare. (Fig. 519.) In this instrument the platinum wire loop is made a little larger than the ring and tied at its distal end by means of a thread. The tonsil is now engaged and the wire drawn closely around it, and when this is fully and thoroughly accomplished the current is turned on and the wire drawn slowly home. Jonathan Wright has applied this means of removing tonsils to the ordinary Mackenzie guillotine. The advantage claimed by some in the use of these electric instruments for the removal of tonsils is that the amount and even the possibility of hemorrhage is moderated or prevented; on the other hand, the disadvantage is that in addition to the wound itself there is a cauterized surface.

Fig. 519.



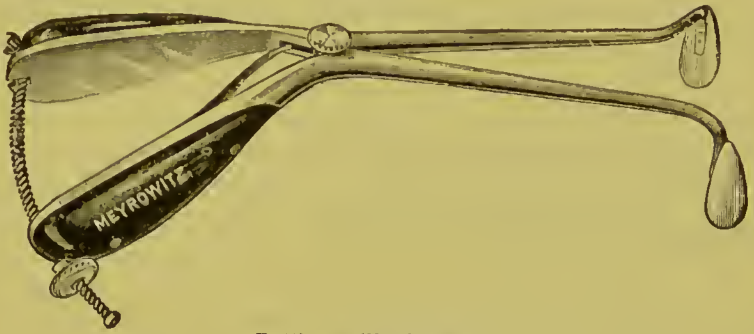
Knight's tonsil galvanocautery snare.

When one decides to remove tonsils by means of local anæsthesia, then each one is to be swabbed over with a 10 per cent. solution of cocaine. The use of a mouth-gag and an assistant to steady the head depends entirely upon the patient's self-control. The use of cocaine in no sense makes the operation a painless one. It may moderate it; but in the writer's experience the operation itself, even with the local anæsthesia, is an extremely painful one.

Hemorrhage at the time of the tonsillotomy is apt to be profuse in young children and in adults when the guillotine is used. In the case of children it soon ceases, but in adults it may be troublesome. This, however, in the case of adults is considerably lessened by removing the tonsils by means of the cold wire snare, electric snare, or electric guillotine. As precautionary measures, it is advisable that the patient, subsequent to the operation, be not allowed to lie down, but assume a semirecumbent position; that the blood be allowed to escape from the mouth without any effort on the part of the patient; therefore, all clearing of the throat should be avoided, and the use of the voice abstained from (secondary hemorrhage two days after the operation has been met with in the writer's experience, due to the want of the last observation). Food. in as concentrated a form as possible, and requiring but little mastication, should form the diet. The hemorrhage, when moderate, is usually arrested by the use of iced cold drinks or small pieces of ice held in the mouth. Locally, a solution of adrenalin chloride (1 : 1000), applied by means of a pledget of cotton-wool held against the bleeding surface, will in some cases act well.

A mixture of gallic and tannic acid in the proportion of one to three, with sufficient water to make a thick paste, applied by means of the index finger, has also proved of use. The use of the perchloride tincture of iron must be applied with caution, the cotton-wool swab should not be surcharged, as otherwise it will then flow into the pharynx and cause unpleasant symptoms. If, however, the hemorrhage be very profuse, these measures are of little avail; then one must, with good illumination, carefully search for the bleeding point and catch it by means of a pair of long artery forceps, and if possible, a ligature placed around it; if not, then the stump of the tonsil must be well drawn out and a strong ligature placed around its base. Butt's tonsillar hæmostat (Fig. 520) has been found of service in arresting hemorrhage.

FIG. 520.



Butt's tonsillar hæmostat.

Wingrave has drawn attention to the occurrence of a rash (either papular, roseolar, or erythematous in type) following tonsillotomy; but, as many of the patients operated upon were taking sodium salicylates and potassium bromide, the importance of its occurrence can be of little moment.

The after-treatment of cases of tonsillotomy is absolute rest in bed for two or three days, the use of soft food, and on the third day an alkaline and antiseptic spray or gargle. The reaction is usually slight, and on the second or third day a thin white pellicle is seen on the surface of the cut tonsil, which, however, soon disappears. General tonic treatment is especially indicated in strumous children after such operative procedures.

4. ENUCLEATION. In order to carry out this method of removing the tonsil the anterior pillar is drawn to one side, and by means of the index finger the tonsil is removed from its bed. This may be further assisted by lifting out the tonsil by means of a pair of forceps; the bleeding is usually free but easily arrested by pressure.

Foreign Bodies in the Tonsils. These may be of any kind or nature, the most common being fish-bones, spiculæ of bone, bristles of a tooth-brush, and husks of grain. The most common site is the centre of the tonsil; but frequently they are hidden behind the anterior pillar of the fauces. By repeated swallowing the foreign body, and especially in the case of fish-bones, is apt to be driven deeply into the substance of the tonsil, leaving a very minute portion of it exposed. Sometimes this portion is covered with secretion, and at first sight the foreign body may be overlooked. It will, therefore, become necessary when there is difficulty in finding it, to mop off any secretion which may be covering the tonsil. The removal of foreign bodies in this region is easily accomplished by means of a pair of forceps, giving immediate relief to the symptoms produced by its presence.

Tonsilloliths. Frequently the retained cheesy secretion in the crypts undergoes calcareous degeneration, constituting what it known as a calculus or tonsillolith. They vary in consistency, chemical composition, and size.

Symptoms. The presence of a calculus may produce no symptoms at all, and may be accidentally discovered; usually, however, there is a sense of fulness about the tonsil, frequent attacks of subacute tonsillitis and cough may also be present. The existence of such a condition is usually discovered by probing the tonsil, although the calculus itself may sometimes be visible within the crypt.

Treatment. Single and small calculi may often be dislodged by means of a curette or probe, or it may be so engaged in the tonsil that it is necessary to enlarge the opening freely in order to extract it.

Benign Tumors of the Tonsils. The most common of the benign tumors of the tonsil are the *papilloma*, *fibroma*, *fibrochondroma*, *angioma*, and *echinococcus cysts* also occur. These tumors may be either sessile or pedunculated. When sessile they cause little or no disturbance; but when pedunculated they may produce symptoms reflexly, such as cough, spasm of the glottis, difficulty in swallowing, attacks of dyspnœa, and even asphyxia. Their removal is easily accomplished by either the scissors or snare.

Malignant Tumors of the Tonsils. These embrace *sarcomata* (lymphosarcoma and fibrosarcoma) and *carcinomata*.

Sarcomata. Sarcoma of the tonsil may occur at any age, but is usually found in young individuals between the ages of fifteen and twenty-five years. It is said to be more common in men, but in the writer's cases (six) they were all in females, and the ages were between fifteen and thirty years. This disease only attacks one tonsil.

Symptoms. The symptoms are usually those of a mild attack of tonsillitis, for which the patient is continually treated, or it is even regarded as an enlarged tonsil, and when the tumor becomes definitely pronounced, it is then regarded and treated as a case of "quinsy." The pain in sarcoma is not a marked feature, and when present is not a continuous one, but is of a rather dull character, in contradistinction to the sharp lancinating pain of carcinoma. There is a feeling of fulness about the throat, and deglutition is difficult, which gradually increases with the size of the tumor. The voice becomes thick, and as the case advances respiration becomes difficult, necessitating tracheotomy; deglutition at such a stage is usually impossible. Emaciation is not a marked symptom in the early stage of the disease, but these patients usually are very anæmic. There is little tendency to ulceration, and hemorrhages are therefore rather infrequent. The lymphatic glands are not usually enlarged. In advanced cases there is often some febrile disturbance. Upon examination in the early stage of the disease the tonsil shows a little fulness; it is pushed toward the median line, and the soft palate in its immediate neighborhood shows a slight fulness, and the bloodvessels become more numerous and dilated. (Plate XXX., Fig. 1.) The condition gradually increases until the isthmus of the fauces is closed.

Diagnosis. In the early stage sarcoma of the tonsil often resembles a subacute parenchymatous tonsillitis or a hypertrophied tonsil, but the inflammatory condition, in spite of all treatment, still continuing should lead to suspicion. The question of a gummatous infiltration is easily solved by the use of antisyphilitic treatment.

Treatment. In the early stage the tumor may be enucleated by incising the capsule with the galvanocautery knife; in the more advanced stage of the affection a more extensive operation by means of pharyngotomy may be undertaken. But for steps involving such operative procedure reference to standard surgical works is advised. In this kind of malignant growth Coley's serum has been used in some cases with benefit; in two of the author's cases this method of treatment proved of no avail. In hopeless cases palliative measures are called for, and tracheotomy may be needed as a relief to the dyspnœa.

Carcinoma. In carcinoma of the tonsil the affection usually shows itself as an epithelioma. As a primary growth it is rare, usually being an extension from the surrounding structures. It is a disease of middle and advanced ages; the tumor rapidly enlarges, and may present itself as an apparently enlarged tonsil (Plate XXX., Fig. 2); but upon a careful examination, whereby the posterior and internal surfaces of the tonsil are thoroughly exposed, an ulcerated condition may be observed. (Plate XXX., Figs. 3 and 4.) The pain is often marked

PLATE XXX.

FIG. 1.

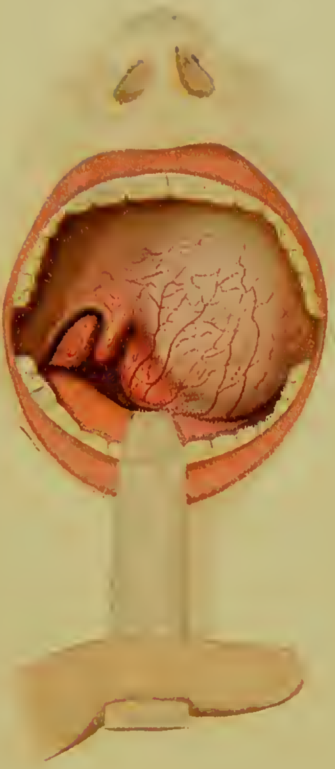


FIG. 2.

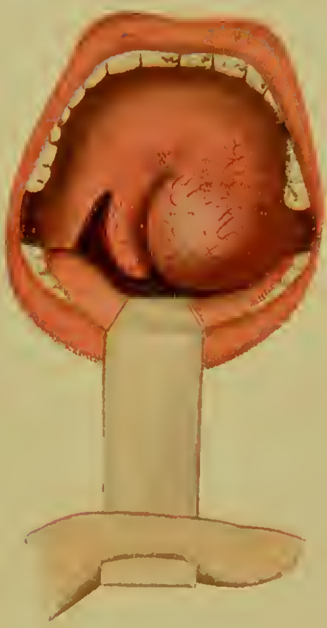


FIG. 3.

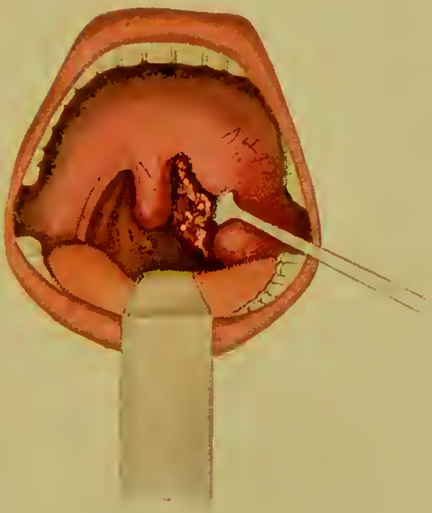
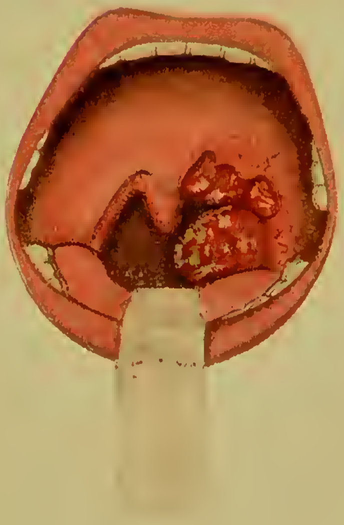


FIG. 4.



Figs. 1 and 2. Primary Epithelioma of Tonsil, showing the initial stage. Fig. 3. The Ulcerated Surface Exposed. Fig. 4. Showing the Extension of the Lesion. (Author's case.)

and lancinating in character, extending into the ear on the same side, aggravated by deglutition, but occurring independently of it. The flow of saliva is increased, and the discharge from the ulcerated surface is usually fetid. Glandular involvement is early and the progress of the disease rapid, involving the adjacent structures. The effects upon the constitution are marked anæmia and cachexia.

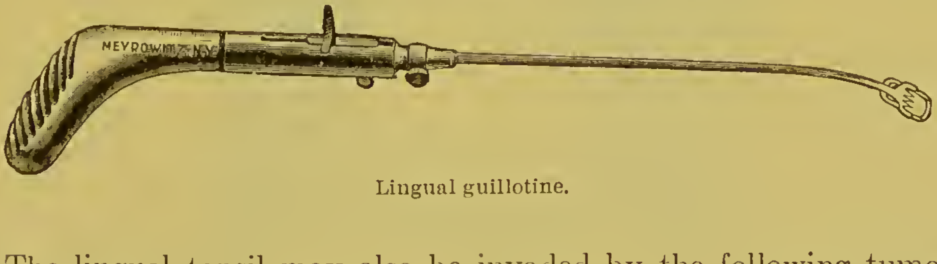
Diagnosis. The disease may be confounded with primary or tertiary syphilitic manifestations, but treatment directed toward this as a possible cause will clear up the question. Microscopic examination of a portion will assist in aiding the diagnosis in many cases.

Treatment. Dealing with these cases by means of the snare and galvanocautery knife are not to be advocated, but the more thorough surgical measures are indicated, and reference should be made to standard surgical works for the methods of operative technique.

The Lingual Tonsil. This tonsil is situated at the root of the tongue and just in front of the epiglottis. In structure it is similar to the faucial tonsil and belongs to the ring of lymphatic tissue described as the "Ring of Waldeyer." In some cases the tonsil is divided by a median line, thus giving to it an appearance of two distinct glands. This tonsil is subject to many of the same affections which attack the faucial tonsils, especially the acute catarrhal, lacunar, and phlegmonous inflammation, mycosis, tuberculosis, and syphilitic manifestations. The appearance of these conditions is similar to those seen in the faucial tonsils, and repetition of either their subjective or objective symptoms and treatment is unnecessary.

The commonest form of affection of this tonsil is hypertrophy. The affection is one of adult life, and is more common in females than in males. It is frequently met with in hysterical subjects, and is productive of the condition known as "globus hystericus." It produces symptoms of a feeling of a foreign body in the throat, irritating cough, and a weakness of the voice in many cases. The treatment is carried out on the same lines as that for hypertrophy of the faucial tonsil, and consists in the use of either the galvanocautery or, in cases where the enlargement is considerable, of the guillotine especially devised for that purpose. (Fig. 521.)

FIG. 521.

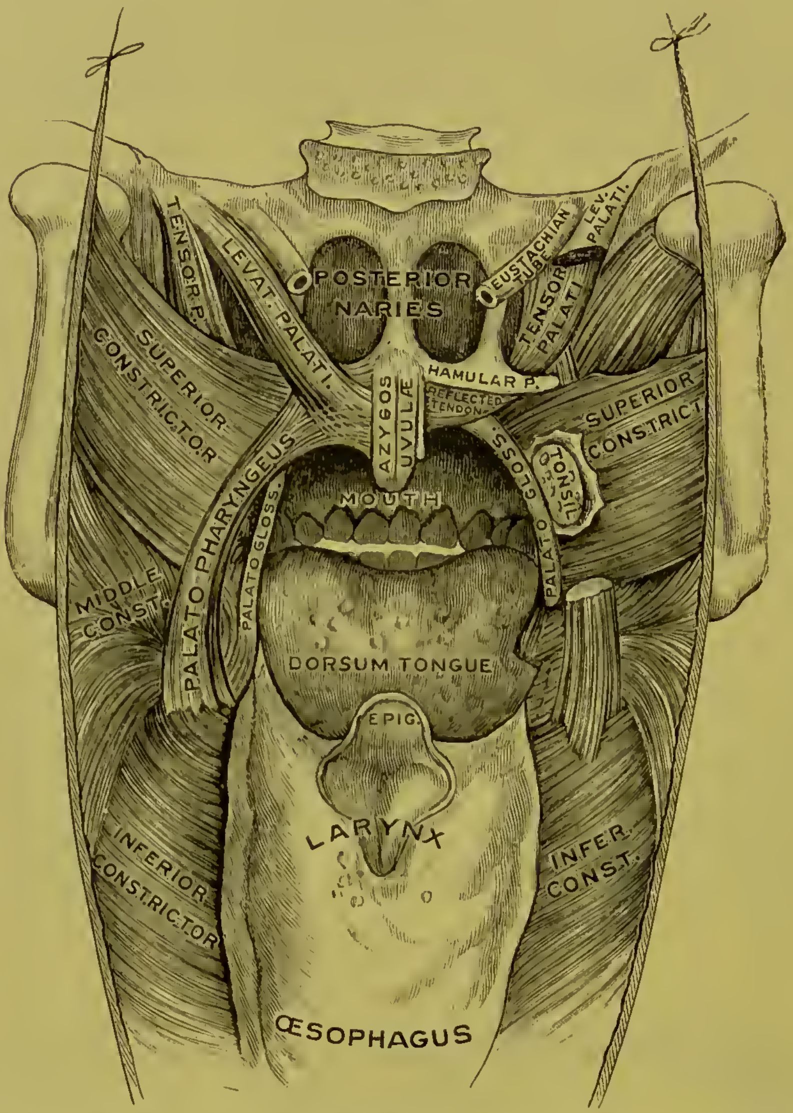


Lingual guillotine.

The lingual tonsil may also be invaded by the following tumors: fibroma, papilloma, lipoma, angioma, and cysts. A portion of the thyroid gland may in some cases be seen, and is then due to a previous state of the thyroglossal duct.

A "varicose" condition of the veins at the base of the tongue is sometimes met with, and its presence in some cases produces a feeling of a foreign body in the throat and often paræsthesia. Very occasionally these veins may be the source of hemorrhage; and this has given rise to the opinion that the patient has had an hæmoptysis. The application of the galvanocautery point will relieve many cases.

Fig. 522.



Showing the nasopharynx and the laryngopharynx opened from behind. (Modified from Gray's Anatomy.)

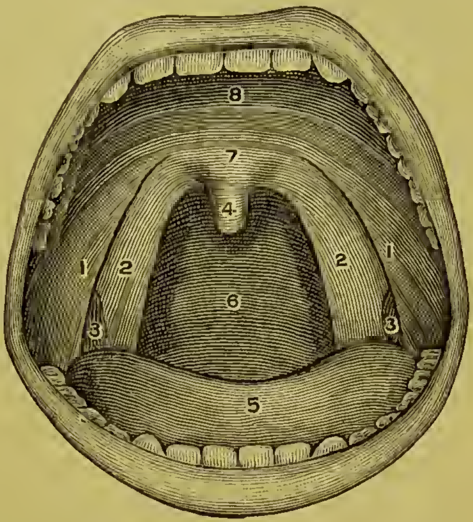
The *nasopharynx* lies between the base of the skull and the lower edge of the soft palate. Into this space the following openings are observed: the posterior nares (two), and the mouths of the Eustachian tubes (two). (Fig. 522.)

The *oropharynx* is that portion of the pharynx visible when the mouth is open and the tongue depressed to the floor of the mouth. (Fig. 523.)

The *laryngopharynx* extends from a line drawn horizontally backward to the posterior wall of the pharynx from the root of the tongue, and extends to the upper border of the cricoid cartilage. (Fig. 522.)

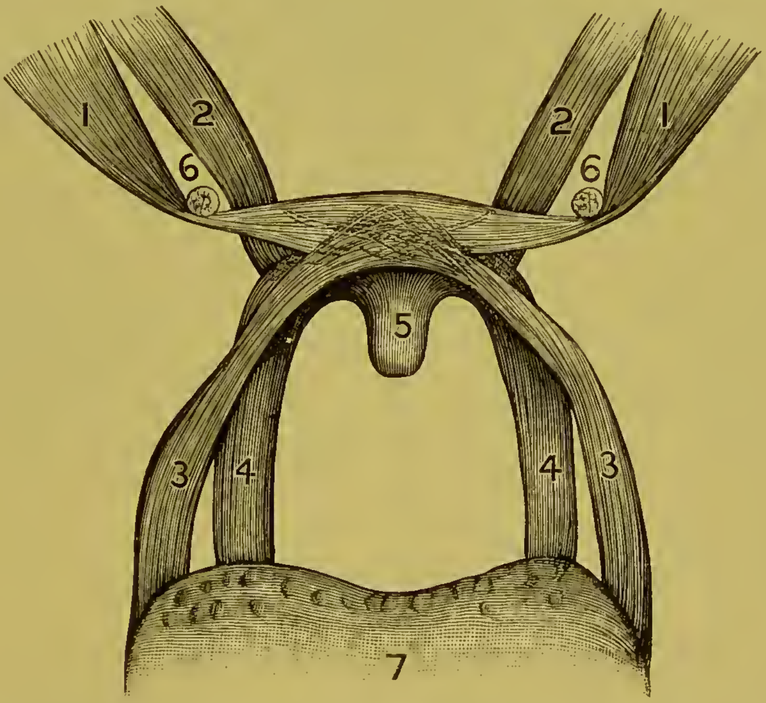
Malformations and Deformities of the Pharynx. A congenital malformation rarely met with consists of the pharynx ending in a cul-de-sac below the level of the cricoid cartilage, and the œsophagus terminating in the posterior surface of the trachea. Another congenital condition is the occurrence of diverticula; they are found in the lateral wall of the pharynx, and are due to some modification in the closure of the first postmandibular visceral cleft. These diverticula may be single or multiple and correspond with that of Meckle in the intestine.

FIG. 523.



1. Anterior pillar. 2. Posterior pillar. 3. Tonsil. 4. Uvula. 5. Tongue. 6. Posterior wall of pharynx. 7. Soft palate. 8. Hard palate.

FIG. 524.



1. Tensor palati. 2. Levator palati. 3. Palatoglossus. 4. Palatopharyngeus. 5. Azygos uvulæ. 6. Hamular process. 7. Tongue.

Pharyngocele. This condition consists of a pouch-like formation in the lower part of the pharynx, said to be due to a weakness of the constrictor muscles in one place.

The symptoms which occur in these cases of diverticula or pharyngocele are practically the same. Food fails to reach the stomach, and is regurgitated in small quantities from time to time. If a bougie is passed it is arrested in its course to the œsophagus by entering one of the pouches. The existence and situation of such pouches are very materially demonstrated by the use of the Roentgen rays, a bougie or other foreign body having first been passed into the pouch.

Stenosis of the pharynx may occur primarily as the result of disease (syphilis, tuberculosis, scarlet fever, diphtheria, smallpox, and erysipelas), or traumatically as the result of injuries incident to the swallowing of corrosive liquids (carbolic acid, lye, etc.), of scalding water, or inhalations of steam in considerable quantity, or secondarily, as the result of pressure from the following conditions: retropharyngeal abscess, spinal caries, glandular enlargements, and especially when the thyroid gland intervenes between the trachea and upper part of the œsophagus, as the writer has seen in several cases of enlarged thyroid.

Wounds of the soft palate, tonsils, and pharynx frequently occur as the result of the action of corrosive liquids or of the entrance of a foreign body through violence applied to it. Among such foreign bodies are pipe-stems, pieces of wood, or metal. Injury involving complete perforation of the soft palate and partially involving the posterior wall of the pharynx has been seen by the writer in two cases: in one it was due to the child falling while he had a pea-shooter in his mouth, the other occurred in a man falling while in an intoxicated condition and striking his pipe, which he held in his mouth at the time of the accident. In some cases the injury may be of such a nature as to involve important bloodvessels in the throat, and when this does occur hemorrhage may lead to a fatal result.

Anomalous distribution of the **ascending pharyngeal arteries** is sometimes to be seen in the posterior wall of the pharynx. The most common anomaly is to see the artery coursing upward on the posterior wall close to the lateral wall of the pharynx. It may occur on one or both sides; less frequently it has been observed coursing transversely from one side to the other. The internal carotid artery has been found to take an irregular course and appear just under the mucous membrane in the lateral wall of the pharynx (Kelly). Such conditions would render operative measures in this region very dangerous.

DISEASES OF THE PHARYNX.

Acute Pharyngitis. **Etiology.** Among the causes of an acute inflammatory condition of the pharynx may be mentioned sudden exposure to "cold," the existence of a chronic catarrhal pharyngitis, the extension of catarrhal conditions from the nose and nasopharynx, a gouty or rheumatic diathesis, gastric or intestinal disorders, acute infectious fevers (measles, scarlet fever, smallpox, typhoid and typhus); sometimes the use of certain drugs may cause it, such as iodide of potassium, mercury, antimony, arsenic, and occasionally the salicylates; the excessive use of tobacco or alcohol, highly-seasoned food and confinement in close and ill-ventilated rooms.

Symptoms. These are usually ushered in by a chilliness and feeling of malaise; the throat is sore, especially when swallowing, the pain extending upward to the ears; there is a feeling of irritation and a desire to frequently clear the throat. The general disturbance depends upon the severity of the local conditions. Upon examination the color of the mucous membrane covering the soft palate, uvula, pillars of the fauces and posterior wall of the pharynx is seen to be a bright pink or livid hue. Its surface in the early stage is dry, and numerous dilated vessels are visible; the uvula and edge of the soft palate may be slightly œdematous; later on the secretions form which at first are clear mucus, but later become mucopurulent.

Treatment. In severe cases, and even in mild cases occurring in frail individuals, confinement to bed is advisable. At the outset a mercurial (gr. iij calomel) followed in six hours by a Seidlitz powder is to be given. Should the temperature be elevated and the pulse full, tincture of aconite (B. P.) in two-minim doses, hourly administered, will greatly relieve the discomfort experienced in the early stage of the disease. Salol (gr. iij) combined with phenacetin (gr. iv) or benzoate of soda, or salicylate of soda, will be found beneficial where there is a rheumatic history. Locally, small pieces of ice to suck or ice-bags to the throat will be found comfortable. The dryness so frequently complained of may be relieved by steam inhalations of compound tincture of benzoin (one drachm to the half-pint). The use of an oil spray such as the following will give relief to the pain:

Menthol,		
Camphoræ,	āā	gr. ij.
Ol. gaultheriæ,		♏j.
Alboline,		℥j.

Sig. Use as a throat spray hourly.

When the secretions have begun to form, then an alkaline spray is indicated, such as:

Sodii bicarbonatis,		
Sodii birboratis,		
Sodii chloridi,	āā	gr. iij.
Aquæ,		℥j.

Later on, when the secretion has become mucopurulent, then a slightly astringent spray, used about three times daily, is indicated:

Liq. hydrastis,		♏xv.
Tr. lavandulæ co.,		♏iij.
Aquæ,	ad	℥j.

Chronic Pharyngitis. This may be defined as a chronic inflammation of the mucous membrane of the pharynx and adjacent structures, attendant with structural changes in the glandular element or connective tissue. It may be conveniently considered under three headings:

1. Simple chronic pharyngitis.
2. Chronic granular pharyngitis.
3. Atrophic pharyngitis.

Simple Chronic Pharyngitis. **Etiology.** This may be the sequence of subacute or acute attacks of pharyngitis as the result of an extension of chronic nasal catarrh, the existence of nasal and pharyngeal conditions producing buccal respiration; the abuse of tobacco and alcohol, the use of highly-seasoned foods, gastric and hepatic disturbances, anæmia, tuberculosis, and syphilis all act as etiological factors; occupation, where a great deal of dust or irritating vapor is present in the atmosphere.

Symptoms. They are those of an acute pharyngitis considerably modified. The most prominent symptom is the clearing of the throat to such a degree that the patient may retch or even vomit in his endeavors to clear the throat of secretion. This retching as the result of such efforts is usually found in those individuals who indulge too freely in the use of alcohol and tobacco; the voice may become husky, and frequent efforts are made to clear it. In those who sing there is often a difficulty experienced in reaching the higher notes of the register. Cough may be present, especially when associated with an elongated uvula; repeated efforts of coughing or clearing of the throat may lead to a slight rupture of minute bloodvessels and show itself as minute specks of blood in the expelled secretion. Upon examination, which not infrequently is made with difficulty, on account of the extreme irritation of the mucous membrane, one observes the mucous membrane of the pillars of the fauces, soft palate, and uvula to be very hyperæmic. The color may vary from a bright red to a livid hue. The posterior wall of the pharynx shows numerous dilated vessels, and its surface is covered with a very tenacious mucous secretion.

Treatment. The basis of treatment in the majority of cases lies in the correction of faulty habits; the use of stimulants and tobacco should be strictly interdicted; a gouty or rheumatic diathesis should receive proper attention; heavy and high living individuals should be advised as to their proper dietary, and any existing nasal or nasopharyngeal condition likely to produce buccal respiration should be corrected. Locally, after the throat has been cleared of any adherent mucus by means of an alkaline spray, a solution of nitrate of silver (gr. x to ℥j), protargol (gr. xv to ℥j), or zinc chloride (gr. xx to ℥j) may be applied by means of a cotton-wool swab.

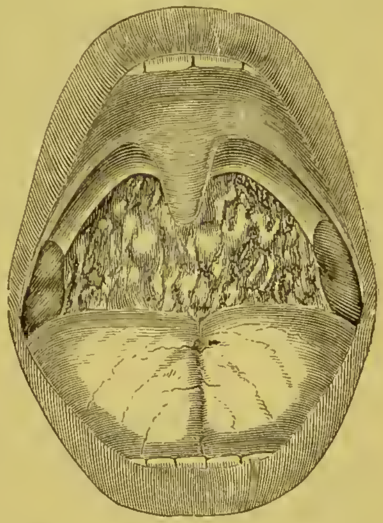
Chronic Granular Pharyngitis. This is characterized by a chronic inflammation of the mucous membrane with hypertrophy of the lymphoid follicles.

Etiology. In enumerating causes for this affection one requires, to a great extent, to repeat those acting as causes in chronic pharyngitis, and for these one is referred to that section. In addition, the improper use of the voice, either in speaking or singing, will act as a cause. This has led to the name "clergyman's sore-throat" being given to it.

Symptoms. There is a feeling of more or less discomfort in the throat, frequent clearing away of a rather tenacious mucous secretion, the voice is often husky or weak and the use of it leads to a feeling of fatigue and an aching sensation of the muscles of the neck. One, however, must not be misled that in each patient in whom such symptoms are present they necessarily are of local origin. The writer believes that many of the local symptoms and conditions produced in singers and speakers are due to improper methods of voice production. Upon examination the posterior wall of the pharynx shows the glandular element to be distinctly enlarged and hyperæmic; the enlargement varies in size from that of a pin's head to that of a pea. The surrounding mucous membrane is pale, and on its surface, coursing toward these so-called "granulations," are several fine bloodvessels. This collection of "granulations" is often very marked in young children who are the subjects of postnasal growths. (Fig. 525.) Frequently bands of hypertrophied tissue are to be seen on the lateral wall of the pharynx and just behind the posterior pillars. The hypertrophy continues into the nasopharynx with the salpingopharyngeal fold. This condition is called by many authors "pharyngitis lateralis hypertrophica."

Treatment. This should, as in the case of all local troubles, be directed toward the investigation of the general health for causes, and these corrected. Any anæmic, lithæmic, or gouty condition should receive proper attention, and the use of alcohol and tobacco should be prohibited if acting as an exciting cause. Nasopharyngeal conditions should be carefully investigated and suitable treatment applied. Locally, in pronounced cases, the best form of treatment is the application of the galvanocautery to each granule and destroying the bloodvessels which supply it. This should be very carefully done. The application of chromic acid, trichloracetic acid, or silver nitrate fused on a probe is also advocated; but the application of any such escharotic is not so easily limited as the use of the galvanocautery. The galvanocautery point should, when being used, be brought only to a dull red heat. Mayer has very successfully used a specially formed curette for removal of these granulations, and claims to have had very satisfactory results. The curette as used by him is seen in Fig. 526.

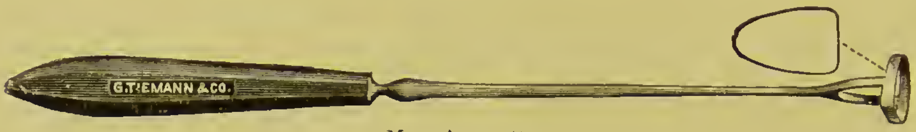
FIG. 525.



Granular pharyngitis. (COAKLEY.)

Preceding the use of any one of the foregoing methods, each "granule" to be so treated should receive an application of a 10 per cent. solution of cocaine. In the case of the lateral hypertrophy the bands may be so thick as to require excision by means of scissors and forceps; but in this procedure one must be careful not to exceed the requirements of the case by overdoing it.

FIG. 526.



Mayer's curette.

Atrophic Pharyngitis. This is characterized by atrophy of the mucous membrane and glandular structure contained in it. It is held by some writers to be a sequence of a chronic pharyngitis, and by others to originate *per se.* It may follow severe cases of diphtheria or scarlet fever, or may occur in the course of diabetes or Bright's disease. It is usually an evidence of the same process existing in the nose and nasopharynx. A dry condition of the pharynx, not necessarily atrophic, may be produced by mouth-breathing and excessive smoking.

Symptoms. The symptoms are those of a feeling of dryness in the throat and a desire to frequently clear it. Upon examination the wall of the pharynx looks dry and glazed. The pharynx looks spacious in many cases, and the mucous membrane is covered with a thin layer of hardened secretion which, when removed, reveals often a rather congested-looking mucous membrane.

Treatment. The general state of the patient's health must be carefully investigated and treatment directed to any existing diseases which might possibly act either as an exciting or a predisposing cause. Locally, the use of alkaline sprays such as Dobell's solution or Seiler's tablets will assist in some cases to remove the hardened secretion. The subsequent application of a mixture such as the following will be of benefit:

Iodini,	gr. v.
Potassæ iodidi,	gr. ij.
Glycerini,	ʒiij.
Aquæ,	℥j.

Steam inhalations, such as compound tincture of benzoin, one drachm to the half-pint, or the following, will be of use in relieving the dryness:

Creasote,	♏lxxx.
Magnesiæ carbonis levis,	gr. xl.
Aquæ,	℥j.

Sig. One teaspoonful in half a pint of boiling water, and use as an inhalation night and morning.

These inhalations give the most benefit when the pharynx has been thoroughly cleared of any dried secretion. One must bear in mind that the above measures are only a means to make the patient more comfortable, for the disease in its advanced form is practically incurable.

Acute Phlegmonous Pharyngitis (Ludwig's Angina). Senator defines this condition as "a diffuse purulent inflammation in the deeper tissues of the pharyngeal mucous membrane, which thence is propagated to the larynx and the glands, and secondarily involves also other organs. The disease has attacked persons previously in full health and without any etiological factor being demonstrable." As a primary disease it is rare and often fatal.

Symptoms. The onset is marked by a rigor or chilliness. The first symptom referable to the throat is dysphagia, which suddenly sets in. This is closely followed by hoarseness, dyspnœa, and even laryngeal stridor. There is considerable difficulty in getting rid of the secretions of the throat, which are very tenacious in character. The fever is high (103° to 105°), and the pulse rapid and weak. Upon examination either one or both tonsils and the pharynx on one side or both show evidences of acute inflammation; the color is of a very deep red or livid hue. This condition may extend downward, involving the epiglottis and the aryepiglottidean folds. These parts become swollen and distended, accounting for the increased dysphagia, stridor, and the deeply-pitched tone of the voice. Externally, a board-like hardness of the tissues is appreciable on palpation.

Treatment. The condition is always a very grave one, and stimulating and supporting treatment from the outset is indicated. Iron and quinine, in large doses, should be given; cold to the throat by means of ice-bags or Leiter's ice-coil should be used. Frequently scarification of the epiglottis and aryepiglottidean folds will reduce the swelling of these parts and render the dysphagia and stridor less marked. When symptoms of obstruction to respiration set in, tracheotomy is called for.

Gangrenous pharyngitis is a rare disease, and is found occurring as a sequence of a severe attack of scarlet fever, measles, diphtheria, or smallpox. It may not be limited to the pharynx itself, but have had its beginning in the soft palate or tonsils, and extended to the pharynx, or vice versa. General sustained and stimulating treatment is indicated, with cleansing of the local condition by the use of antiseptics.

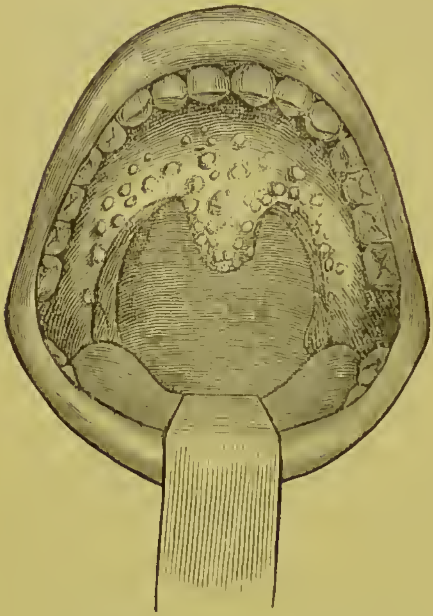
Herpes of the Pharynx. This affection is characterized by the presence of small vesicles on either the soft palate, uvula, tonsils, or buccal mucous membrane, and, more rarely, the pharyngeal wall, epiglottis, and larynx. It occurs as the result of exposure to cold or septic influence. In the writer's experience it occurred in three cases during the course of an attack of la grippe. It may attack one or both sides.

Symptoms. Before the appearance of the vesicles there is a feeling of heat and pain in the mouth and throat, increased salivation; the febrile disturbance is marked. There is considerable pain when masticating or swallowing. Upon examination the vesicles appear as small blisters, varying from a pin's head to twice that size. (Fig. 527).

The contents of the vesicles are at first clear, but in a few hours become turbid and yellow. They then break and leave an underlying hyperæmic area.

Treatment. Nothing, either general or local, has been found to apparently curtail the course of such an affection. General tonic treatment is, of course, indicated and locally, the only remedy which the writer has found of use is the application of orthoform to each spot. The disease is a very tedious one and the course apt to be prolonged. This affection may also be seen in a chronic form, where the vesicles appear and disappear only to reappear. The vesicles may coalesce, and the exudate may appear as a thin, yellowish-white membrane. The condition is unattended by any general disturbance. In one case seen by the writer it occurred in an elderly man who had been operated upon for a large sarcoma of the neck, and the occurrence of the herpes was probably due to injury of some of the nerves.

Fig. 527.



Herpes of soft palate and uvula. (Author's case.)

Another, perhaps, somewhat allied affection is pemphigus. This shows itself in the eruption of large bullæ on the soft palate, uvula, and posterior wall of the pharynx or larynx. Rarely are the bullæ seen, for they are generally ruptured by the slightest contact, and their previous presence is shown by areas of a thin, white exudate varying in size. In a case seen by the writer it was attended by a bullous eruption on both forearms. No treatment seems to avail very much in these cases, and it should be based on general principles.

Parasitic Diseases of the Pharynx. The most common parasitic affections of the pharynx met with are: first, thrush; second, mycosis.

1. **Thrush.** This affection is usually met with in children who have been improperly fed. It may also occur in adults who are in a debilitated state of health. Hyperacidity of the secretion of the mouth favors its development. This condition is not limited to the pharynx, but may be seen on the soft palate and buccal mucous membrane. It is due to the presence of the oidium albicans, the most common of vegetable parasites found in the mouth.

Symptoms. In infants and young children there is difficulty in swallowing and a regurgitation of food. In the case of infants they refuse food, and very soon become badly nourished in consequence. Upon examination the mucous membrane of the mouth, soft palate, and pharynx may seem to be dotted here and there with numerous white opalescent spots of exudation, which, when removed, reveal the underlying mucous membrane hyperæmic. The use of the microscope will show the presence of the filaments of the oidium albicans.

Treatment. As the disease is of a parasitic nature, one's efforts must be directed to the destruction of the parasite. The old-fashioned remedy of borax and honey, painted on the parts, still answers very well. Applications of a weak solution of nitrate of silver (gr. iij to ℥j) will also be found useful. The general hygiene of the patient must also be attended to as well as that of the oral cavity.

2. **Mycosis.** Mycosis of the pharynx is a chronic affection characterized by the appearance of small white spots on the tonsils, posterior or lateral walls of the pharynx, and due to the presence of the vegetable parasite leptothrix. It is usually met with in adult life, and is more common in women than in men. All catarrhal conditions of the pharyngeal mucous membrane favor its development, as also do debilitated conditions of the system, dental caries, and acidity of the saliva. It may occur on any or all portions of the "lymphoid ring" of Waldeyer; therefore, it is seen on the faucial, lingual, or pharyngeal tonsil, or on the posterior and lateral walls of the pharynx and pillars of the fauces.

Symptoms. Very frequently there are no symptoms until the patient has accidentally discovered the presence of "white spots" in the throat and has become uneasy about them. Sometimes these patients complain of a feeling of a foreign body in the throat and of a desire to swallow repeatedly, or frequently clearing the throat. Upon examination "white spots," varying in number, are seen variously distributed on the tonsils (faucial and lingual), posterior and lateral walls of the pharynx, and in the nasopharynx. These spots look like white bristly points standing out a very short distance from the mucous membrane of the invaded parts and to which they tenaciously adhere. Any doubt as to the nature of the affection (liable as it is to be confounded with such affections as tonsillitis or diphtheria) is set at rest by the microscopic examination. In this affection there is an entire absence of any general disturbance.

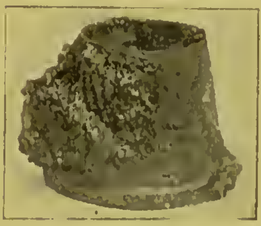
Treatment. This affection, like some of those occurring at the base of the tongue (moderate hypertrophy of the lingual tonsil and "varix"), is apt to occur in neurotic and run-down individuals, and therefore attention to the general health is the most important. When demanding interference, which is seldom, the use of the galvanocautery points to each spot, which is a tedious process when the spots are numerous, and excision of the invaded parts, where possible, are the only means to be relied upon. The use of local antiseptics (parasiticides), in the opinion of the writer, avails nothing.

Hemorrhage from the pharynx is a condition occasionally met with, and may be mistaken for hæmoptysis. It is usually due to a small vessel, either on the posterior wall of the pharynx or root of the tongue, being ruptured through violent efforts to clear the throat, or of retching. In two cases the writer met with, it occurred always with menstruation. Cases of hemorrhage of the throat must be seen at the time of occurrence in order to be sure that it is not due to pulmonary disease. When the bleeding point is located the application of the galvanocautery point will usually suffice.

Foreign Bodies in the Pharynx. Foreign bodies which are found in the pharynx may be of any nature, but are usually fish-bones, spiculæ of bone, bristles of a tooth-brush, coins, nut-shells, false teeth, husks of grain, etc. They may become lodged in the substance of any of the tonsils in the case of sharp penetrating objects, behind the pillars of the fauces, in the epiglottic fossæ, in the pyriform sinus, and in any part of the œsophagus, but especially at a point opposite the cricoid cartilage, or, through efforts at coughing or attempts at dislodgement, they may be found in the nasopharynx.

The **symptoms** present depend upon the nature, size, and situation of the foreign body. Discomfort from a feeling of irritation in the throat, a constant desire to swallow, even to inability to swallow, and when, from its size, it is either situated at the entrance to the larynx, and is in such a way as to interfere with the ingress or egress of air, or when in the œsophagus, and sufficiently large to press upon the posterior wall of the trachea, symptoms of dyspnœa may be present. In the case of a foreign body being lodged in the nasopharynx, which is a very unusual occurrence, there may be no symptoms present at all, either from its smallness or situation, or it may, when large, produce nasal catarrh and obstruct nasal respiration. In the writer's case of a foreign body in the nasopharynx, it was an ordinary tailor's brass thimble. (Fig. 528.) This at first was in the lower part of the pharynx, and, perhaps, on reaching the entrance to the larynx, it was blown into the nasopharynx through violent efforts of coughing. It was lodged in this region for eighteen years, and had, when the writer saw the patient, produced a chronic nasopharyngitis and concomitant symptoms affecting the hearing. One must be sure of the exact location of the foreign body before any attempt is made to extract it, because occasionally symptoms are produced simulating the presence of a foreign body, but which are entirely due to the scratching or abrading of the mucous membrane by the passage of the foreign body downward into the œsophagus and stomach. If the foreign body be situated in the lateral walls of the pharynx or the upper portion of the œsophagus, its exact locality may be more clearly defined by making the patient retch while under observation.

Fig. 528.

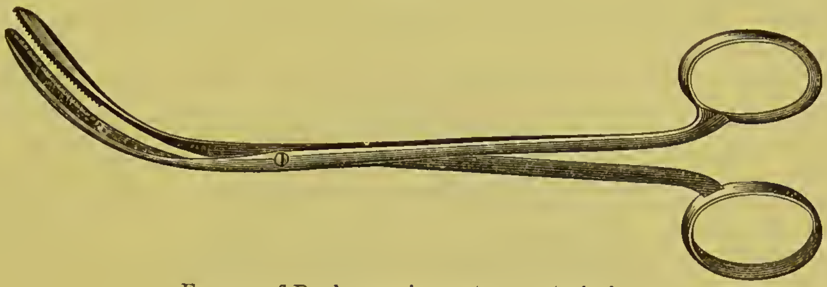


Tailor's thimble in nasopharynx, natural size. (Author's case.)

The removal of a foreign body occurring in any portion of the pharynx can readily be done by forceps suitably adapted for the region in which it may be situated. This should always be undertaken with the region properly illuminated.

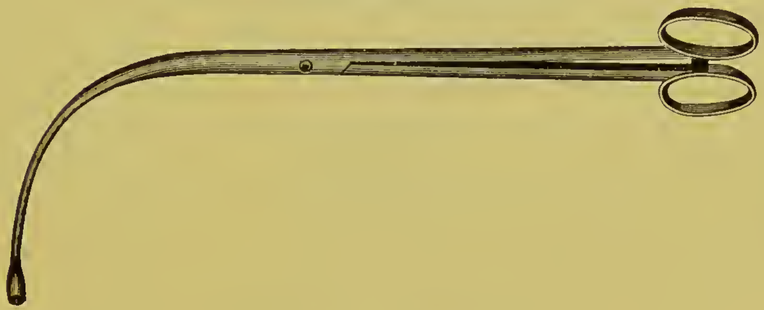
One must be careful in not mistaking certain anatomical points for foreign bodies. One case has been met with in the writer's experience where the family physician mistook the ascending cornu of the hyoid bone, which was very prominent beneath the pharynx, for a supposed foreign body, and in another the sharp point of the hamular process of the pterygoid plate of the sphenoid bone had been mistaken for a pin supposed to have been impacted in the nasopharynx.

Fig. 529.



Forceps of Buck, opening antero-posteriorly.

Fig. 530.



Forceps of Fauvel, opening laterally.

Tumors of the Oropharynx. Both benign and malignant tumors may involve this portion of the pharynx. In the case of malignant growths they usually are an extension into the pharynx from disease in the neighboring structures. Primary carcinoma of the pharynx is rare. The growths most commonly met with in this region are considered under the parts they especially invade, viz.: soft palate, uvula, and tonsils, to which section the reader is referred. Tumors of the nasopharynx will be dealt with when considering diseases of that region.

Retropharyngeal Abscess. Primary retropharyngeal abscess is a suppurative process which takes place in the lymphatic nodules situated between the prevertebral fascia and the tunica pharyngea externa.

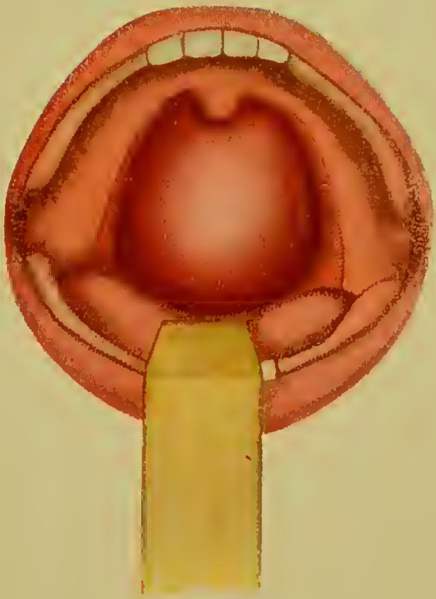
Etiology. The disease occurring primarily is an affection of infancy, between the ages of six months and one year. It is uncommon after three years of age, and the reason of this is said to be that after three years of age the chain of lymph nodules most marked up to that age rapidly disappears. It may be acute, as the result of adenitis and from the intimate connection between the lymphatics of the pharynx and those of the soft palate and tonsil, or it may be a sequence of an inflammatory condition involving these regions from any cause whatsoever. The disease may occur in tubercular and rhachitic children. Retropharyngeal abscess when occurring secondarily does so as a sequence of spinal caries, and is then chronic in its nature. In this form the disease is more frequent in adults, and the pus is situated between the spinal column and the prevertebral muscles and ligaments. It may occur traumatically from the impaction of a foreign body in the posterior wall of the pharynx.

Symptoms. The symptom first showing itself is the refusal by the infant to continue to take nourishment, evidently from the pain and difficulty of swallowing. The child is restless and feverish. As the case progresses there is difficulty in breathing, either through the nose, if the abscess be seated in the nasopharynx, or through the larynx, if it be seated low down in the laryngopharynx. In the first case the mouth is widely open, and the child snores, and in the second case there is laryngeal stridor. The voice has a nasal character and the noise like a hen clucking accompanies respiration; the neck is rigid, and the head is held toward the affected side. Cough is frequently present. There is sometimes a marked swelling in the neck on the affected side between the sternocleidomastoid muscle and the angle of the lower jaw. The abscess, when due to lymph nodules breaking down, forms rapidly, but when due to bone disease develops slowly. In some cases there is only a lymphadenitis, and then the symptoms are much less pronounced and not as urgent. When one proceeds to the inspection of the throat this should be done very gently, as rough handling may unexpectedly rupture the abscess, with perhaps unpleasant if not fatal results. It may be necessary to insert a mouth-gag in order to carry out this inspection; this too should be gently done for the same reason. When the pharynx is well illuminated a swelling occupying either a central or lateral position on the posterior wall of the pharynx is observed. It bulges forward, and may, if large enough, throw the soft palate forward; the swelling is decidedly hyperæmic, and upon examination is found soft and fluctuating. (Plate XXXI.)

Diagnosis. The disease has been mistaken for croup and quinsy; but a careful consideration of the general symptoms and inspection and palpation of the swelling will readily lead to a correct diagnosis.

Treatment. In cases where there is only a lymphadenitis and the symptoms present very mild, the application of hot fomentations and general tonic treatment have led to the absorption of the inflammatory condition. When, however, there are distinct evidences of pus being present operative measures are at once indicated. There are two methods of dealing with such cases: first, by an incision

PLATE XXXI.



Retropharyngeal Abscess. (Author's case.)

through the pharyngeal wall, or, second, by an external incision in the neck.

1. The first method is accomplished as follows: The child is wrapped in a blanket, and by this means movements of the arms and legs are restricted. The nurse holds the little one in her arms, with the child's head resting on her left shoulder; the head should then be steadied by an assistant. The mouth-gag is introduced and gently opened. With the swelling well illuminated a vertical incision is made into the centre of the swelling by means of a straight-backed knife. The exit of pus is rapid, and in many cases considerable in quantity, and as a forethought to such an occurrence the child's head is immediately held well forward and downward to allow the pus to escape through the mouth, which otherwise might find its way into the larynx and produce suffocation. In a day or two a re-collection may take place, necessitating reopening of the abscess. In rare cases the opening of the abscess may not give relief to the symptoms, and then one must make a careful examination for the possible existence of another abscess lower down.

This method of operating has its many advocates, but there are many objections to it. The abscess cannot be properly drained, and any drainage that may take place is swallowed by the child; the opening may close too soon and pus reaccumulate. Proper antiseptic precautions cannot be taken, and there is always a danger of suffocation from the pus, for, no matter how carefully done, one cannot tell how rapidly the pus may escape.

2. By an external incision (Hilton's method): This operation should be carried out with all the usual steps of strict asepsis. The incision is made behind the sternocleidomastoid muscle, beginning one inch below the tip of the mastoid process and extending downward for one inch. The skin and fascia are incised until the muscles forming the floor of the posterior triangle of the neck are reached. Then carry out the rest of the operation by means of blunt instruments passing behind the deep vessels and nerves of the neck. This is best done by means of a grooved director and with one finger in the pharynx. When the abscess cavity is reached and opened a pair of forceps should be inserted, closed, and when within the cavity opened and withdrawn in that state; this will enlarge the opening freely. A careful examination by means of the finger will enable the operator to further ascertain the existence or non-existence of any further complication. A drainage-tube of good size is then inserted and the usual aseptic dressings applied. Subsequent washing out of the cavity with boric-acid solution may be necessary for a few days, and at the end of a week the tube may usually be withdrawn and the wound allowed to close.

The writer, in his experience, believes this to be a better method of operating than the former, on account of the better drainage, better asepsis, and that the operation once done is completed. It is also a more surgical and more scientific method of procedure. This method of operating is the only one which should be adopted when dealing with the chronic form of retropharyngeal abscess associated with spinal caries. In these cases such part of the caries as it is possible to remove should be dealt with. Subsequent to any operative measures the patient always requires general tonic treatment.

DISEASES OF THE NASOPHARYNX.

Acute Nasopharyngitis. The affection localized to the nasopharynx itself is very seldom met with, and its existence as a primary disease is doubted by many, it usually being concomitant of an acute rhinitis.

Etiology. Usually, it is an extension of the inflammatory affection from the nose or pharynx. Children in whom there is an enlargement of the lymphoid tissue are especially prone to it. It may occur in the course of any of the exanthemata; sudden climatic changes may also act.

Symptoms. The symptoms may in severe cases be ushered in by a chill or feeling of malaise; there is a sense of fulness in the head and slight tinnitus aurium, dryness at the back of the nose, and deglutition is painful. Later on, that is, in the course of twenty-four to thirty-eight hours, there is a thin mucous discharge, very tenacious and stained with blood, which subsequently becomes mucopurulent. At this stage of the disease there is on the part of the patient a desire to hawk and expectorate, and the voice may become a little husky. In children, the onset is marked by decidedly febrile disturbance, rapid pulse, and high temperature (102° to 104° F.); further, many children become temporarily mouth-breathers because of the involvement of the pharyngeal tonsil in the acute inflammatory process. Upon examination with the rhinoscope in adults there is in the early stage marked swelling, redness, and dry appearance of the mucous membrane of the vault and posterior wall of the pharynx. When the stage of secretion has set in the mucous membrane is bedecked with a mucous or mucopurulent secretion. In children it is often impossible to make a satisfactory rhinoscopic examination; but when it is permitted one observes the lymphoid tissue, and especially the pharyngeal tonsil, to be much swollen, hyperæmic, and glazed, and sometimes small spots of exudation are seen.

Treatment. Should the disease be concomitant with an acute rhinitis, the treatment as detailed under that disease should be followed out. One should begin with a mild mercurial purgative, such as calomel, gr. iij, to be followed in the course of eight hours by a Seidlitz powder; phenacetin in small doses (gr. ij) every two hours will relieve the febrile condition. When secretion has set in, an alkaline lotion, such as bicarbonate of soda (gr. x to ℥j), may be used. In cases where the postnasal syringe is tolerated, this is the best way of using the solution; but in other cases one must be satisfied by spraying through the anterior nares. In the early stage steam inhalations of compound tincture of benzoin (℥j to Oss), and the subsequent application of a weak solution (gr. v to ℥j) of nitrate of silver will moderate the amount of secretion. In children very little local treatment can, as a rule, be carried out with much effect. However, the writer has found that a small quantity of the following ointment introduced into each nostril three or four times a day seems to give relief:

Hydrargyri oxidi rubri,	gr. v.
Paraffin,	gr. viij.
Vasel. alb.,	ʒj.

M. Ft. ung.

Chronic Nasopharyngitis. This affection is a chronic inflammation of the nasopharyngeal mucous membrane. It is essentially a disease of adult life, and the symptoms of a chronic nasopharyngitis in childhood are indicated by the presence of adenoid vegetations.

Etiology. Frequent and neglected attacks of acute nasopharyngitis, changes of climate, syphilis, tuberculosis, rheumatism, gout, anæmia, gastro-intestinal disorders, abusive use of alcohol and tobacco, occupations where there are irritating gases or dust, overheated rooms, suppurative diseases of the ethmoidal and sphenoidal sinuses, hypertrophy or atrophy of the pharyngeal tonsils, nasal stenosis due to septal deviation, spurs, hypertrophic rhinitis, polypi, etc. Tornwaldt has laid great stress upon certain pathological changes in the so-called bursa pharyngea (bursitis) as a very frequent cause of postnasal catarrh. Upon this point, however, there are many opinions, and notably Schwabach, who contends that the pharyngeal bursa is nothing more than the persistence of the median cleft in the pharyngeal tonsil. Adhesions between the edges of the cleft in the pharyngeal tonsil may lead to the retention of pathological products, and by a complete inclusion may produce a cyst, these conditions acting as a source of postnasal catarrh.

Symptoms. The most frequent symptom complained of by the patient is the presence of a mucopurulent secretion at the back of the nose, which either drops into the throat or is of necessity removed by hawking. This symptom is especially prominent upon first rising, and often attempts at the removal of the secretion are so energetically carried out as to produce retching. Very frequently these patients produce a very disagreeable noise, made by sending a sudden blast of air through the posterior nares, as if trying to dislodge something from the nasopharynx into the nose. In many cases of long-standing aural symptoms (varying degrees of dulness of hearing and tinnitus) may be present. Through the extension of the catarrhal process downward, or the influence which the condition has upon structures below the seat of this affection, huskiness is frequently met with. Indirectly, dull headache (frontal or occipital) is produced, and there is a tendency to repeated colds in the head. Upon examination the nasopharynx is seen by means of the rhinoscope to be covered, either uniformly or discretely, with a mucopurulent secretion, or dried into a hardened crust. This latter condition is especially to be noted in the centre of the vault of the pharynx, and is said by Tornwaldt to be pathognomonic of disease of the bursa pharyngea. The secretion or crust when removed shows the underlying mucous membrane to be either hyperæmic, or in some cases practically normal. Removal of crusts and a careful examination of the nasopharynx afterward is essential, as it occasionally happens that upon removal of the crusts there is found to be a specific ulceration present. The pharyngeal tonsil is sometimes seen to be swollen or atrophied, and in many cases, through openings left by partially adherent clefts in the tonsil, a mucopurulent secretion is seen exuding.

Diagnosis. The condition may be mistaken for suppurative processes involving the sphenoidal, posterior ethmoidal, or even the maxillary sinus, and to the chapter on these affections the reader is referred.

Treatment. In all local affections one must never forget the probability of a constitutional condition being answerable for the local trouble; therefore, careful investigation into the probable existence of any such condition should receive careful attention, and be treated accordingly. Locally, the secretions should be removed by alkaline sprays—bicarbonate and the biborate of soda (gr. x to ℥j water). This may be used by means of an atomizer, or, better, by a postnasal syringe, for, as a rule, the spray from the atomizer is not sufficiently strong to dislodge the tenacious secretion or the crusted formation. When the surface is freed from secretion or crusts, the application, by means of a cotton-wool swab, of a solution of nitrate of silver (gr. x–xx to ℥j) or chloride of zinc (gr. xv–xxx to ℥j) may be applied. In making such an application the cotton-wool swab should not be surcharged with the solution to be used, as the excess may find its way into the larynx, producing what may appear to the inexperienced, alarming stridor. In adults, where the disease is dependent upon an atrophied condition of the pharyngeal tonsil retaining secretion through adhesions, the removal of the tissue by means of a Gottstein curette is indicated. Some authors recommend the application of solid nitrate of silver or the galvanocautery point to obtain the same result. A cyst or submucous abscess may be dealt with by either of the foregoing methods.

Atrophic Nasopharyngitis. This condition is always associated with a similar condition of the nose. It is characterized by a glazed and dry appearance of the mucous membrane which, in many cases, is covered with crusts of a dark-green or yellow color.

It presents many of the symptoms in common with the same affection of the nose, and for the treatment of which the reader is referred to the article under "Atrophic Rhinitis."

Hypertrophy of the Pharyngeal Tonsil. In the nasopharynx there normally exists lymphoid tissue which, when collected together in the vault, constitutes what is known as the pharyngeal or third tonsil (Luschka). This tonsil may be the subject of an acute inflammation, and may be attacked by similar processes to those which attack the faucial tonsils. There is one affection, however, to which very little attention has been paid, namely, an acute inflammatory condition of the pharyngeal tonsil. This affection is found to attack most frequently young children, and its onset is usually marked by slight indisposition or a chill followed by marked elevation of the temperature (101° to 103° F.). There is marked difficulty in breathing through the nose, and the child's voice becomes thick. The nasal secretions are later on (in the course of a couple of days) increased and changed in character, being at first thin and clear, but subsequently become mucopurulent. In many cases the affection may be attended with an acute catarrhal otitis media. The treatment consists of a mild purgative, the syringing of the nostrils with an alkaline and antiseptic solution, such as Dobell's, and the application of the following ointment within the nostrils every four hours:

Hydrargyri oxidi rubri,	gr. jss–ijss.
Paraffin,	gr. iv–viij.
Vasel. alb.,	℥ij.

M. Ft. ung.

Adenoid Vegetations or Postnasal Growths. The affection which is most commonly met with is where the pharyngeal tonsil becomes chronically enlarged, and when such is the case it is commonly known as *adenoid vegetations*, or *postnasal growths*.

Etiology. It is an affection largely met with in children, although occasionally met with in adult life. In the author's collection of cases the ages at which such a condition was most frequently found were between three and five years; the earliest age in which it was met with is a single case at three weeks, the oldest at forty-five years. As to sex, there is a slight predominance in favor of males. That heredity plays some part, the writer believes there is no doubt, as in his total cases there were no less than fifty-three families in which from two to four children were the subjects of hypertrophy of the pharyngeal tonsil.

In the table on page 1024 are given the writer's statistics, taken only from his private practice. The total number of cases was 1605, occurring among 10,000 patients. This represents 16 per cent. of cases in which adenoids or adenoids and enlarged tonsils were found to exist.

After some of the infectious fevers, especially measles and scarlet fever, it would seem as if the affection were precipitated. Climate, where there are extremes of heat and cold, seems to be favorable to its development. Repeated attacks of acute nasopharyngitis tend to hypertrophy of the lymphoid tissue. The pharyngeal tonsil is apt to undergo atrophy after puberty, and the writer has also seen this take place following a severe attack of nasal and nasopharyngeal diphtheria.

Symptoms. The existence of adenoids is very frequently recognized by the facial expression of the child, although one must be very careful in making a diagnosis from this alone, as is so often done, because marked anterior nasal stenosis may produce a similar expression of countenance. Children who suffer from chronic enlargement of the pharyngeal tonsil are of two types: one is of florid countenance and well nourished (Fig. 531), and the other is pale and thin looking. (Fig. 532.)

Age.	Adenoids.			Adenoids and tonsils.			Grand Total.		
	Male.	Female.	Total.	Male.	Female.	Total.	Male.	Female.	Total.
3 weeks	1	0	1	...	...	...	1	0	1
Under 1 year	14	4	18	5	3	8	19	7	26
1 "	4	2	6	8	0	8	12	2	14
2 years	13	10	23	18	16	34	31	26	57
3 "	30	19	49	46	37	83	76	56	132
4 "	29	21	50	36	33	69	65	54	119
5 "	29	40	69	40	42	82	69	82	151
6 "	42	26	68	31	28	59	73	54	127
7 "	31	31	62	36	29	65	67	60	127
8 "	36	25	61	26	26	52	62	51	113
9 "	17	25	42	21	15	36	38	40	78
10 "	28	29	57	17	19	36	45	48	93
11 "	20	15	35	18	14	32	38	29	67
12 "	21	26	47	16	15	31	37	41	78
13 "	24	10	34	11	11	22	35	21	56
14 "	23	15	38	10	10	20	33	25	58
15 "	25	9	34	9	8	17	34	17	51
16 "	23	13	36	1	12	13	24	25	49
17 "	9	4	13	3	0	3	12	4	16
18 "	7	8	15	2	3	5	9	11	20
19 "	2	3	5	1	1	2	3	4	7
20 "	30	26	56	11	10	21	41	36	77
21-25[1] "	25	19	44	5	8	13	30	27	57
26-30 "	11	12	23	1	4	5	12	16	28
31-40 "	1	0	1	1	0	1	2	0	2
45 "	...	...	...	1	0	1	1	0	1
	495	394	857	374	344	718	869	736	1605

In both the mouth is open most of the time, the nose thin, the nostrils narrow, the depression on either side of the alæ deeper than normal, the upper lids may droop, and the general expression is often dull, listless, and idiotic. Upon questioning the parents, one may elicit the fact that the child is a mouth-breather, especially at night, and it may be so marked that the child snores. In some cases there may be even a struggle for breath to such an extent as to alarm the parents, and the child may start up from its sleep quite frightened (night-terrors). These symptoms of disturbed breathing are moderated when the child is turned so as to sleep on its side. Varying degrees of deafness may be noted, which condition may pass off in warm weather. From this very fact of the deafness being only temporary, and of a slight degree in some cases, parents are apt to pay little attention to it. Repeated attacks of earache, followed by a discharge in some cases, are frequently met with. Colds in the head are of frequent occurrence; of some children it may be said that they seem to have a constant cold in the head. A cough, especially when the child is asleep, is noted, and liability to attacks of croup and bronchitis is also met with. The voice is decidedly thick and without resonance; it sounds as if the child had a severe cold in his head; letters requiring the nasal chambers for their resonance are wrongly pronounced, thus, "m" becomes "b" and "n" becomes "d." In very marked cases there may be even difficulty in breathing when eating. In an infant the difficulty in breathing may seriously interfere with its nursing. In a case of an infant three weeks old, operated upon by the writer, it was with the greatest difficulty that the child nursed, having to let go its hold on the nipple very frequently. The result was that it soon emaciated; but, with the establishment of nasal respiration, nursing was carried out without any difficulty, the result being a well-nourished child in the course of a month. Sore-throat is often met with as a complaint, the tonsils in many children being enlarged with the associated adenoids. Attacks of epistaxis are occasionally met with, very rarely asthmatic attacks.

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[1] Inclusive.

FIG. 531.

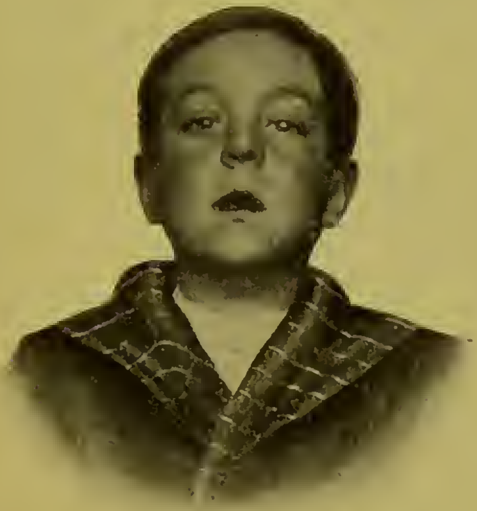
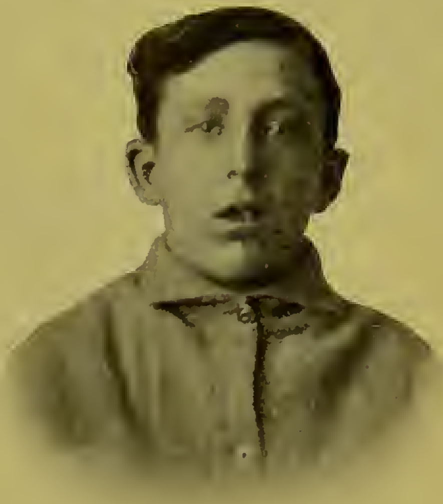


FIG. 532.



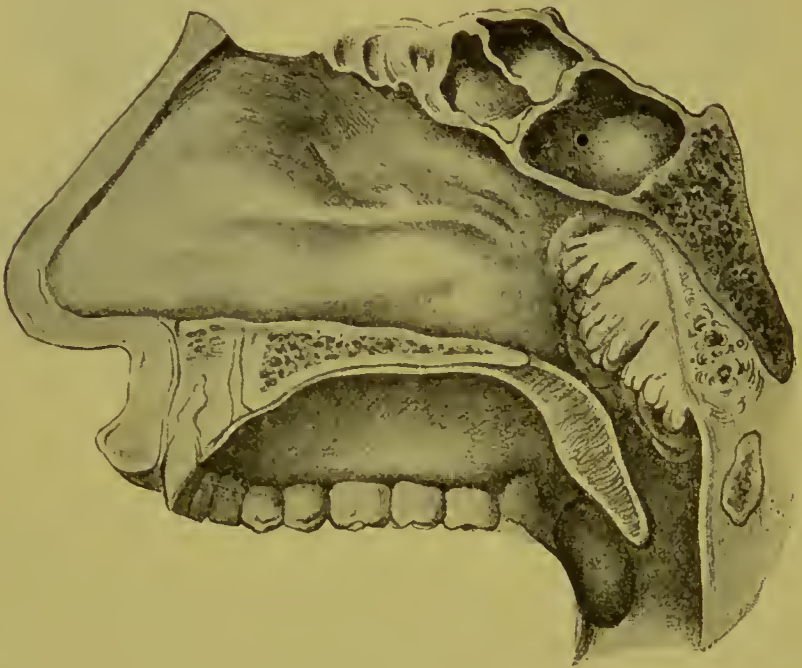
Types of the "adenoid" facies.

When mouth-breathing is very marked and has existed for a considerable length of time an alteration in the shape of the chest is produced in some cases. The result is a pigeon-shaped chest. The occurrence of a V-shaped maxilla as the result of mouth-breathing is doubted by many authorities. It was found in 1.5 per cent. of the writer's cases.

When the amount of adenoid is small a symptom frequently met with is the attempt on the part of the child to dislodge something from the back of the nose by a short expiratory movement. In some cases of adenoids there is an inability on the part of the child to fix his attention, and to this condition Guye has given the name "aprosexia." The submaxillary glands are frequently found enlarged. The existence of adenoids is occasionally to be found answerable for many cases of persistent and recurring phlyctenular keratitis and conjunctivitis.

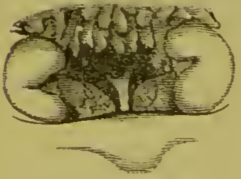
Diagnosis. The recognition of the existence of hypertrophy of the pharyngeal tonsil may be carried out by one or two methods. The first method is by posterior and anterior rhinoscopy. Posterior rhinoscopy is not often carried out successfully in many children; but, when allowed, the mass is recognized as a rose-colored growth, situated either on the vault of the pharynx, on its posterior wall, or on both. It obscures from above downward to a greater or lesser degree the posterior parts of the septum and middle turbinated bodies. In some cases even the posterior parts of the inferior turbinated bodies are totally hidden. When occupying the vault the surface of the collection is either stalactite (Fig. 533) or smooth in appearance. It may be noticed in some cases that the lymphoid hypertrophy stretches across the vault and occupies Rosenmüller's fossæ. This examination, if not carried out satisfactorily, may be assisted in some cases by anterior rhinoscopy. The nostrils having been carefully sprayed with a 4 per cent. solution of cocaine, any existing temporary hypertrophy of the nasal mucous membrane being thus reduced, will enable the

FIG. 533.



Antero-posterior section of the head of an adult, showing the situation and gross structure of hypertrophy of the lymphoid tissue of the nasopharynx. (ZUCKERKANDL.)

FIG. 534.



Hypertrophy of the pharyngeal tonsil. (COHEN.)

examiner to see the mass, in some cases blocking the posterior nares, and when marked the movement of the soft palate upon either swallowing or phonating "eh" is not seen to rise in the normal manner.

Should these methods fail to determine their existence, then digital examination must be carried out. This is done as follows: The child's arms should be held by another person, and the examiner holds the child's head between the left side of his own body and his left arm, and the thumb of the left hand, having been previously protected by a thick towel around it, is placed well back between the child's upper and lower molars of the left side. The first finger of the right hand is then gently passed up behind the soft palate, and will immediately impinge upon a soft mass into which it is easily embedded. By means of this examination the extent of the mass may be learned by its relation to the septum and orifice of the Eustachian tubes. Upon withdrawal of the finger it is usually found tinged with blood, and sometimes a little blood may escape from the nostrils.

In children where the tonsils are enlarged it may be impossible to carry out posterior rhinoscopy on account of their size; then digital examination will be necessary. The posterior wall of the pharynx shows in many cases marked hypertrophy of the lymphoid tissue in the region of the oropharynx, and is of itself very suggestive of a similar condition existing in greater quantity in the vault of the pharynx. Examination of the tympanic membranes in many cases will show them to be retracted, dull, and the handle of the malleus in a very horizontal position; or, should a purulent otitis media be present, a perforation of varying size will be noted. Prominence of the second cervical vertebra has been mistaken for adenoids when the examination has been made by the rhinoscopic mirror; but digital examination will clear up any doubt.

Prognosis. Before giving a prognosis as to the outcome of any operative procedure to be undertaken for the removal of adenoids, the various conditions of the patient and other associated local conditions must be first thoroughly considered. First and foremost to be inquired into is the possible existence of any hæmophilic tendency; although this is a rare occurrence, yet should it be overlooked the result would probably be disastrous to the patient. Again, depending upon the symptoms for which the child is to receive relief, one's opinion must be based upon certain possible associated local conditions. Thus, if mouth-breathing be the most prominent symptom, one must be careful that no alteration in the shape of the upper jaw (V-shape) be present, that no preternatural narrowing of the nasal passages, no marked deviation or large spur of septum, be present; otherwise, the disappointment to the parents as to the result will be marked. If deafness be the chief symptom, then the condition of the tympanic membranes and the tympani must be noted carefully, the possible existence of a sclerosing otitis media, or a chronic suppurative otitis media, militating against very brilliant results. The question of a possible recurrence has also to be answered, and while, even after a very thorough and complete removal, recurrence may possibly take place, this must receive consideration. Given, however, an uncomplicated case, the prognosis is most favorable.

Treatment. One must bear in mind that not every case of adenoids must be subjected to operative interference. The writer has repeatedly seen cases in which the amount was so small that attention to general tonic and hygienic treatment, the local condition has been followed by such improvement as to require no surgical interference. This is especially the case where the pharyngeal tonsil is found acutely enlarged from some infective cause. Presuming the case is one which demands interference, the following are the steps of procedure, as adopted by the writer:

It is advisable to administer a mild cathartic the day previous to the operation, and the nasal passages should be cleansed by the use of an alkaline and antiseptic lotion, especially if there be increased secretion. Shall the operation be done with or without an anæsthetic? The writer gives it as his opinion that the operation for removal of adenoids, with or without tonsillotomy, should always be undertaken with the patient under an anæsthetic, for the reason that as the operation is done largely on young children the shock of such an operation and the fright attendant upon the sight of blood are sufficient of themselves for avoiding such results. Further, the operation cannot, in the majority of cases, be thoroughly done without an anæsthetic. What anæsthetic should be used? Of the various anæsthetics used, each has its own advocate. Chloroform, A. C. E. mixture, nitrous oxide gas alone, or the use of the gas followed by ether, bromide of ethyl and ether alone, have all been used with good, and, unfortunately, in some cases fatal results, the unfortunate results having followed where chloroform or A. C. E. has been used. The writer has operated on cases in which the various anæsthetics mentioned have been administered, but invariably prefers ether. Alarming effects were produced in several cases in which chloroform or A. C. E. had been used, but with no fatal result. With ether, however, the writer has never seen an unpleasant result either accompanying or following its use.

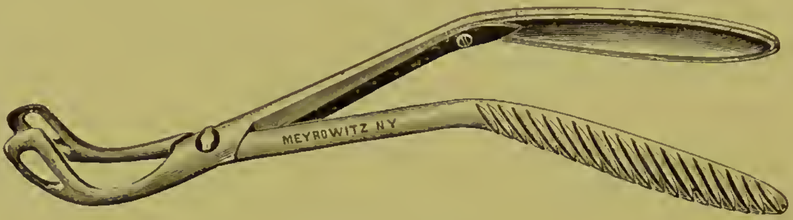
A great deal has been said against ether as an anæsthetic in this operation: that by inciting increased secretion in the throat, danger is added, but, if carefully and *rapidly* administered and not pushed to profound anæsthesia, the writer has not yet seen the mucus increased to such an extent as to increase the danger of its being inspired to such a degree as to produce subsequent bad results.

The next point to be considered is the position of the patient at the time of the operation. One has the choice of three methods: the upright, the lateral, and the Rose. In the upright position the patient is first anæsthetized in the recumbent posture, and then slowly elevated. To facilitate this method French has devised a chair well suited for this purpose. As a substitute the patient may be held on the knees of an assistant, the head resting on the assistant's left side of his chest and the child's head steadied by a second assistant. In the lateral position the patient is placed on his left side, with the left arm drawn from under the side and placed well behind him. In the Rose position the patient is placed on the back, with the head well dependent over the edge of the operating-table. In the writer's practice it is his custom to use a combination of the upright and the Rose position when a tonsillotomy has to be done with removal of the adenoid; but when adenoids alone require removal the Rose position is always adopted.

THE OPERATION AND THE METHOD OF CARRYING IT OUT. The instruments necessary to carry out the operation for the removal of an hypertrophied condition of the pharyngeal tonsil and the faucial tonsils, if enlarged, are as follows: mouth-gag (Denhardt), Mackenzie's modified Physick's tonsillotome, forceps, and a Gottstein curette; of these latter the correct size for each case being selected. All these instruments are to be thoroughly sterilized, and the operator must render his hands as sterile as possible. The preliminary preparations aforementioned having been carried out, the patient being under the influence of an anæsthetic, the patient's hair is enveloped in a towel applied as follows: the towel is folded once lengthwise and the folded edge placed well below the occiput, and the free ends brought forward and crossed over the forehead and tightly pinned. The free part of the towel is folded in upon itself and properly secured. In this manner the hair is entirely protected from being soiled. The gag is now inserted in the left side between the back teeth and opened to the fullest extent the patient's mouth will allow. The operator stands on the right side of the patient, makes a thorough digital examination by means of the first finger of the right hand, thus acquainting himself thoroughly as to the exact distribution of the enlarged lymphoid tissue. This is essential, as it will enable the operator to ascertain whether the case demands the use of the curette alone or the forceps and the curette. If the growth be found to be chiefly situated on the posterior wall of the pharynx, then the curette alone will suffice for its removal. If, however, it be disposed on the vault alone, or on the vault and posterior wall of the pharynx, then both the forceps and the curette will be needed.

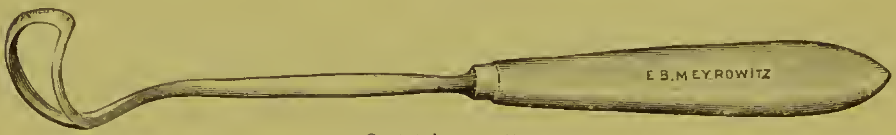
Presuming the tonsils require removal, the writer prefers operating upon them previous to removing the adenoids, for the reason that the field of operation is unobscured by blood, and when this step is undertaken the patient is gently raised and supported, so that the field of operation may be more clearly seen. (In performing tonsillotomy, the method of doing it will be found described in the section dealing with diseases of the tonsil.) After removal of as much of the tonsils as is desired the patient is lowered, and the head, steadied by an assistant, is allowed to hang over the edge of the table. The index finger of the left hand is now passed up behind the soft palate into the nasopharynx and the enlarged lymphoid tissue localized, and the forceps (Fig. 535), held in the disengaged hand, passed up into the vault of the pharynx, and guided to the adenoid by means of the already introduced finger. The mass is now engaged and the forceps closed, care being taken that during this procedure they are maintained strictly in the middle line and that the blades are not thrown too far forward by depressing the handles too much; otherwise the posterior part of the septum may become engaged and a piece broken off. If the forceps be rotated to either side it is possible to engage a portion of either of the Eustachian tubes. By means of the introduced finger the soft palate and uvula are held away, so as to prevent either of them being engaged in the blades of the forceps when closing them. The writer gives a preference to sharp cutting forceps rather than to dull ones, because should the growth be somewhat fibroid it is thoroughly cut through, and there is no danger of tearing the mucous membrane when the forceps are withdrawn, which is very apt to occur in the use of dull cutting forceps. The forceps are reintroduced as often as is necessary to remove any remaining portions. That part of the adenoid which is not readily removed by the forceps, and especially when situated on the posterior wall of the pharynx, is best removed by the Gottstein curette (Fig. 536), which, when introduced, is passed well up to the septum by depressing the handle. Firm pressure is now made, and by elevating the handle the cutting portion of the instrument is thus made to sweep from above downward, removing any hypertrophied lymphoid tissue which may remain in the vault or on the posterior wall of the pharynx.

FIG. 535.



Brandegee's forceps.

FIG. 536.



Gottstein curette.

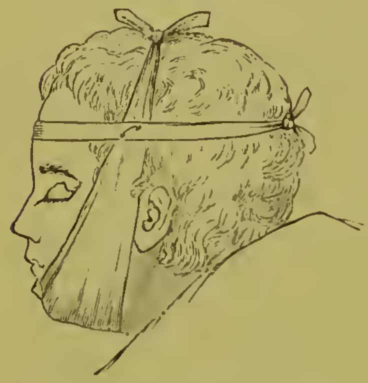
The patient is now quickly turned face downward to allow the blood and clots to escape into a basin previously placed below the patient's head for that purpose. While the patient is in this position, and after the flow of blood has moderated, the index finger of the right hand is now passed up into the vault and any collection of hypertrophied lymphoid tissue in Rosenmüller's fossæ scraped away by means of the finger. It also enables one to be certain that the whole mass of adenoids has been thoroughly removed. The patient is now placed on the table so that his head may rest there, lying on his right side. Care must be taken when placing the head over the end of the table that the neck is not bent too much, for, in young children, in whom the thymus gland is very apt to be enlarged, this movement may produce pressure upon the trachea to such a degree as to bring about alarming if not fatal results.

When operating upon young infants it is not advisable to introduce both finger and instrument, as the procedure might do serious damage by stretching and tearing the structures, but to guide the instrument into the vault under indirect illumination. The hemorrhage attendant upon an operation for the removal of adenoids, especially when combined with a tonsillotomy, is apt to be considerable and even alarming; but, as a rule, it soon ceases and needs no interference. Should it be alarming, then one must carefully inspect for the source of the hemorrhage. If it be from the tonsils, then the methods for arresting it as laid down in the section on tonsillotomy should be tried. If it be from the nasopharynx, the hemorrhage is best arrested by plugging this space with sterilized strips of iodoform gauze. After the operation the patient is immediately placed in bed and allowed nothing for three hours, unless a drink of cold water. After that, if the vomiting has ceased—and it is well to acquaint the parents with the fact that the vomiting of a certain amount of blood will take place—liquid nourishment may be allowed, such as milk, beef-tea, chicken broth, calves' foot jelly. Ice-cream is found very acceptable to many of these little patients, and is very soothing.

Absolute rest in bed is very essential for three or four days, and the diet is gradually improved until about the third day, when the patient's usual diet is allowed. The patient must be cautioned against blowing the nose for the first twenty-four hours, as any undue effort in this way may force blood and mucus into the middle ear and probably set up an acute otitis media. If the nostrils become obstructed by the presence of blood or secretion, this is best dislodged by closing each nostril separately, and gently blowing the open one into a bowl. In the majority of cases no spray for either the nose or throat is necessary; but should there be any increase of the nasal secretion an alkaline and antiseptic solution, such as Dobell's, should be used night and morning. General tonic treatment is occasionally necessary when the improvement of the child's health is not promptly benefited by the operation. The reaction is usually slight, but occasionally the temperature may rise to 100° F., or, as the writer has seen it in two cases, to 104.5° F., within four hours after the operation. The child may be a little restless. The following day these symptoms have disappeared. Occasionally there may be a slight stiffness of the muscles of the back of the neck complained of, and even a torticollis has been met with by the writer; but these soon disappear.

The child's voice is sometimes a little nasal in character, due to a temporary paresis of the palatal muscles, brought about by their being stretched at the time of the operation. This, however, soon disappears and the voice becomes natural. Nasal respiration is usually soon established after the removal of adenoids, provided no other nasal obstruction coexists. But if nasal respiration is not established it may be assisted by tying the child's chin up, as shown in the accompanying illustration (Fig. 537).

Fig. 537.



Method of tying up the chin to favor nasal respiration.

Adenoids occurring in young adults may be removed under local anæsthesia by forceps or nasopharyngeal snare. In such cases the operator requires the co-operation of the patient, and, therefore, it can only be undertaken in very tractable individuals. The oropharynx and nasopharynx are to be swabbed with a 10 per cent. solution of cocaine applied by means of a cotton-wool swab suitably curved. This requires to be done twice within an interval of about ten minutes between each application. The patient is instructed to hold his tongue well down to the floor of the mouth by means of a depressor, the handle of which is well out of the operator's way; then, by means of the rhinoscopic mirror, the forceps, which should be sharp-cutting, or the snare, is guided into the nasopharynx and the portion of the adenoid removed. This is repeated as often as necessary until the mass is thoroughly removed. The great drawback to such an undertaking is the hemorrhage, which is often considerable and obscures the field of operation, thus limiting the amount to be removed at each sitting and necessitating repeated operations. The operation is not by any means a painless one, even if the cocainization has been thoroughly and carefully carried out.

Tumors of the Nasopharynx. 1. Benign Growths. Under this heading may be included *fibromata, fibromucous polypi, cysts, papillomata*, and the more rare affections, *enchondromata, exostoses, lipomata*, and *angiomata*. Of these, those occurring in the nasopharynx most frequently—although by no means common—are the fibromata and fibromucous polypi.

Fibromata. This class of growth, though histologically non-malignant, yet clinically has such features as to be almost regarded as malignant. Usually the growth springs from the region of the basilar process of the sphenoid and occipital bones and from the upper cervical vertebræ. It tends by its rapid extension to invade the neighboring structures, and its prolongations may be found in the nose, superior maxilla, and orbit. It is a tumor found almost exclusively in males between the ages of ten and twenty-five years. A few cases occurring in females have been recorded.

Symptoms. The chief symptoms by which this growth makes itself known are nasal obstruction, hypersecretion, and hemorrhage. By its rapid growth nasal obstruction is noted and soon complete; the disease rapidly invades all structures, and by its extension into the nasal fossæ it displaces the nasal bones, giving to the individual the peculiar "frog-face" appearance. The attacks of bleeding are frequent and at times of considerable quantity; the discharge, which at first was mucus, later on becomes purulent and fetid. Through its prolongations into the nasal fossa it may make itself known externally at the entrance to the nostrils, or produce an exophthalmos, either through direct invasion of the orbit or by its involving the antrum and displacing its roof. The growth may, in advanced cases, be seen to have extended downward, making its appearance in the oropharynx, the soft palate in such cases being well thrust forward, and deglutition and respiration are then frequently interfered with. Headache and severe neuralgia of the fifth nerve are frequently complained of, and vomiting is not uncommon (Escat and Greville-Macdonald). Deafness is also a frequent symptom. Death usually occurs from pyæmia, cerebral involvement, or hemorrhage. Upon examination by means of the rhinoscope and palate retractor the tumor is seen as a light pinkish or dark purplish colored body with smooth, elastic surface, attached either in a sessile or pedunculated manner to the base of the skull or posterior wall of the pharynx. By digital examination the full extent of the nature of the attachment, its mobility, and density of character may be more carefully ascertained. In advanced cases its presence is known by its appearance in the nostrils or nasopharynx.

Diagnosis. There is a possibility that the growth may be mistaken for "adenoids," but careful examination by means of the rhinoscope, the gross appearance, its density, and the large amount of hemorrhage occurring upon digital examination will reveal the fibroid nature of the growth. The differentiation of this condition from sarcoma may be decided by the microscope.

Prognosis. The course of a fibroma when left to itself is usually to a fatal issue, although in exceptional cases at the age limit of this growth it has been found that retrocession has taken place, or the growth has been destroyed through sloughing. If seen early in its development and complete removal undertaken, the prognosis is favorable.

Treatment. This must be of an entirely surgical nature, and the methods at one's disposal are as follows:

1. The galvanocautery snare
2. Cold wire snare
3. Electrolysis
4. Evulsion by forceps

} Extraction through the natural passages.

5. External operation.

1. *The Galvanocautery Snare.* In the application of the loop about the tumor considerable difficulty may be experienced in securing it about the base. This is especially so when the tumor is sessile, and less so when pedunculated. It may be introduced either through the anterior nares or through the oropharynx with the soft palate well retracted, and, by the aid of the first finger in the pharynx, made to encircle the growth. When well in position the wire is tightened, the current turned on, and the wire drawn slowly home. The difficulty in performing this method of operating is, besides that above mentioned, that of securing the loop around the base, and that the wire may break. In heating the wire to a dull-red heat considerable difficulty may be experienced in cutting through the growth, while with a white heat it is cut through so quickly that the attendant hemorrhage is then considerable.

2. *Cold Wire Snare.* This is applied in either of the ways mentioned in using the galvanocautery snare, and the same difficulty is also experienced in the application of the loop. When used the snare must be a most powerful one, such as Farlow's, and the wire should be No. 8 or 10. When in position the wire is screwed home very slowly, occupying a couple of hours, and its use is always attended with a great deal of pain, and the amount of hemorrhage is usually considerable. The advantage of the steel wire is that, through its rigidity, the growth is more easily included and retained than the galvanocautery loop.

A method of including the growth, as suggested and adopted by Greville-Macdonald, is as follows: "With a Belocq's canula or soft Eustachian catheter a piece of thread is carried into the pharynx through the nose, and to the buccal end of this two terminations of a piece of No. 6 piano wire, measuring 18 or 20 inches, are attached in such a manner that on being drawn upward through the nose they will not abrade the surface. By means of the thread the ends of the wire are then drawn into the nasopharynx and nose. As soon as they project from the anterior nares the bent ends are detached with a pair of wire nippers, so that the wire can be threaded into the barrel of the snare to be employed, which is thrust well into the nose before the wire is made fast to the instrument. In this manner a large noose is left in the pharynx which, with the help of the forefinger, can be insinuated behind the tumor. Once this is effected, there will be no difficulty in working the snare on to the highest portion of the tumor and tightening it as it is advanced upward. The growth can then be cut through by gradually shortening the wire."

The advantage claimed for this method of encircling the growth is that it prevents the doubling up of the loop when introduced through the anterior nares and the necessary weakening of the wire by its thus being doubled.

3. *Electrolysis.* This method may be applied in two ways, (*a*) unipolar, and (*b*) bipolar. In the first way both needles are inserted into

the tumor; each needle, up to the point where it is embedded in the growth, is well insulated. In the second method only one pole (negative) is inserted into the tumor, the other (positive), a sponge, is placed on the nape of the neck. The amount of current which can be tolerated without shock to the nervous system varies from 70 to 100 milliampères. The current should not be allowed to pass for longer than ten to fifteen minutes, and the time between the sittings should be from ten days to two weeks, in order to allow the slough to separate.

4. *Evulsion.* This method is carried out either by (*a*) strong nasopharyngeal forceps, whereby the growth is severed piecemeal, or by (*b*) rugines, as especially adapted for this purpose by Escat. Operation by either of these measures has its own advocates, but unless carried out carefully and with a considerable amount of gentleness, damage to the neighboring structures, followed by serious complicacations, is apt to occur. The hemorrhage accompanying this method is always considerably more than that followed by the aforementioned methods.

5. *External Operation.* By this method the tumor is reached through the oropharynx by dividing the soft palate and partially the hard palate, and by means of scissors and raspatoria the growth is extirpated. The hemorrhage is so very free that a preliminary tracheotomy and plugging of the entrance to the larynx by means of a sponge are necessary. Instead of tracheotomy, Doyen has introduced a tubage apparatus which prevents the entrance of blood into the larynx. Hemorrhage following whatever method adopted is to be controlled by pressure. Whatever remnants are left after any operative procedure are to be treated by means of the galvanocautery point.

Fibromucous Polypi. These growths, according to Jonathan Wright, are "fibromata of a sluggish growth which have become œdematous." Their origin is generally in the nasopharynx near the nasal fossæ, into which they may extend. They are usually pedunculated and do not invade surrounding structures. The *symptoms* produced may vary with the size of the tumor, but are those of nasal obstruction with its attendant symptoms. Upon examination, a pale, semitranslucent, pedunculated tumor is seen occupying the nasopharynx, and through the anterior nares its prolongation into that region may be seen. Its removal is easily accomplished by means of the cold wire snare.

2. **Malignant Growths.** Of malignant growths in the nasopharynx *sarcoma* and *carcinoma* occur, but either is very rare. The situation is usually the vault of the pharynx, and the *symptoms* produced are similar to those of fibromata. These growths rapidly break down and invade surrounding structures. In carcinoma the submaxillary glands are early involved. As regards *treatment* in these cases, unfortunately there is little to be done. The results of any operative interference, be it the repeated removal of portions by the snare or forceps or the more extensive measures of resection, are of the same sad nature.

CHAPTER XXIII.

NEUROSES OF THE NOSE AND THROAT.

By EMIL MAYER, M.D.

NEUROSES OF THE NOSE.

That the olfactory sense was capable of a high degree of cultivation was known to the ancients. The Romans possessed slaves, beautiful in form and figure, who prepared their baths with perfumed waters, anointed themselves and their masters, and kept incense burning so that every pleasure that sweet smells might induce was theirs. That these added to their sexual enjoyment they were amply convinced. In recent times, J. N. Mackenzie has called attention to the direct relation of certain areas of erectile mucosa in the nose to the sexual apparatus. Hobbs[1] claims to have cured two cases of chronic priapism by the insufflation of cocaine in the nose. Wright[2] has shown the great amount of erectile tissue in the nasal mucosa of the bull as compared to that of the steer.

Perhaps no one thing in medicine is so remarkable as the strange and peculiarly intimate relations existing between the nose and the genital organs. These are embodied in the investigations of Schiff, in confirmation of Fliess' statement regarding these relations.

His researches go to prove that there is an intimate relation, probably through the sympathetic nervous system, between certain so-called nasal genital spots on the anterior part of the lower turbinate bones, and on the tubercula septi, and the genital tract. Schiff made practical use of this fact by cocainizing these genital spots of the nose as a palliative treatment for dysmenorrhœa. Out of 47 cases treated the pains were relieved in 72.4 per cent. A permanent cure is effected by cauterization of the spots with trichloracetic acid or the galvano-cautery. Mental suggestion was carefully avoided, and general anæsthesia considered to be out of the question. All forms of dysmenorrhœa were treated, and only those in which some abnormal condition of the genital spots was present were amenable to the nasal treatment. The nervous or hysterical form and dysmenorrhœa due to mechanical causes were not influenced. Some cases in which there was a pathological condition of the reproductive organs, in addition to the nasal lesion, were improved or cured by treatment of the nose. It was also shown, experimentally, that during menstruation or in the presence of chronic disease of the genital organs, irritation of the nasal spots caused pain in the lower abdominal and sacral regions. All of these facts lead us to believe that dysmenorrhœa may be caused by lesions of these nasal spots, which seem to take part in the phenomenon of menstruation, and that this form of the disease may be cured by treatment applied to the aforementioned areas of the nose. The treatment must be carried out with care. The spots should be accurately found with the speculum, and touched with a few drops of a 20 per cent. solution of cocaine. A 3 to 5 per cent. solution will suffice if the spots have previously been made bloodless by suprarenal extract. The permanent cure consists in the cauterization of the spot, either during or between the menstrual period, with trichloracetic acid or the electric cautery.

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[1] Laryngoscope, March, 1897.

[2] New York Medical Journal, November 19, 1898.

The writer, believing that the relief afforded by the cocaine in the treatment of dysmenorrhœa was due to the ischæmia produced by the drug, substituted preparations of the suprarenal extract with marked success. In one case the patient was subject to attacks of depression and irritability at each menstrual epoch. At such times the application of a suprarenal preparation (adrenalin 1 : 2000), made twice a day, had a most remarkable curative effect. No suggestion whatever was made that would in any way have influenced the result, nor was the cautery subsequently applied.

The neuroses which affect the nose are those of sensation.

The Sense of Smell or Olfaction.

The sense of smell protects the individual from partaking of unfit foods, adds to his comfort by pleasurable sensations, and in certain vocations is an all-important factor. The centre of the sense of smell is probably situated in the gyrus hippocampi and gyrus uncinatus. The physiology of olfaction is not, according to Vaschide and Van Melle,[1] the result of contact between particles detached from odoriferous substances and the terminations of the olfactory nerves, but it occurs as a result of rays of short wave-length analogous to but not the same as those which we believe give rise to light and the Roentgen phenomena, and which impinge on the olfactory filaments and are perceived as odors. Ayrton[2] coincides with these views.

Experiments have shown that four-fifths of all subjects have the sense of smell more highly developed in the left than in the right nostril, due, in all probability to the greater activity of the left cerebral hemisphere, having in mind the non-decussation of the olfactory nerves.

Toulouse and Vaschide[3] found that the olfactory sense increases up to the sixth year of life, and then diminishes, but the ability to distinguish odors increases with years. They also conclude that the sense of smell tires the least of any of the senses, due, in all probability to the fact that the sense is exercised during inspiration only and rests during expiration. It was also noted that epileptics have as great olfactory power as those not afflicted; their perceptive power, however, is diminished.

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[1] Presse Méd., Paris, January 20, 1900.

[2] Wiener Med Blätter, No. 41–43, 1898.

[3] Bulletin Méd., June 10, 1899; July 8, 1899; September 18, 1899. Soc. de Biol., October 14, 1899.

That the sensation of taste plays an important part in olfaction is shown by Zwaardemaker,[1] who states that the tactile irritation is limited to the anterior half of the nasal cavity and the possibility of the sense of taste must be added thereto. J. W. Patrick[2] adds that smell, sight, sensation, and temperature must all be in union with the sense of taste in order to secure the highest development of the latter.

Deviations from normal conditions of a sensory nature are mentioned under the heading of—

Disturbances of Sensation or of Olfaction.

These are either of the two extremes; they are exaggerated or entirely lost. Those unusual conditions of temporary loss of the sense of smell or temporary exaggeration belong to the anomalies and merely require mention.

Hyperosmia or **hyperosphresia**, an exaggeration of the sense of smell, rarely occasions much disturbance, and is apt to be due to idiosyncrasy. Thus the writer has seen violent headache, nausea, and palpitation of the heart result from the odor of a burning cigarette, and the same condition follow upon the odor of nitrite of amyl, fusel oil, chloroform, etc. Pregnant women are frequently very susceptible to odors of all kinds, and peculiar odors are described as existing in epileptic aura. Körner[3] mentions fainting and asthma as symptoms following this condition.

The **prognosis** is good.

The **treatment** lies in constitutional measures, particularly when due to neurasthenia, anæmia, etc.

Anosmia or Anosphresia. The loss of the sense of smell may be partial or complete, one-sided or bilateral. The degree to which it exists may be quite accurately determined by the use of an olfactometer. Such instruments have been devised and described by Zwaardemaker, Reuter, v. Stein, and Alberto Pini. E. Toulouse[4] proposes the use of flasks containing solutions of camphor water in various strengths, while v. Grazzi[5] suggests the use of an alcoholic solution of benzoic acid as tests for the sense of smell.

Anosmia may be divided into two groups according to Onodi.[6] One group in which pathological changes occur in the olfactory region, or else where some injury has occurred; the second group where the loss of the sense of smell is rather to be referred to mechanical interference with nasal respiration or to functional disturbances. These are termed essential or true anosmia, which may be either central, peripheral, mechanical, or respiratory anosmia.

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[1] Med. Tydschr. v. Geneesek, No. 4, 1899.

[2] Boston Med. and Surg. Journal, June 20, 1899.

[3] Heyman's Handb. f. Lar., etc., 1899.

[4] Rev. de Médecine, Paris, November 10, 1899.

[5] Gazetta degli ospedali, Milan, November and December, 1899.

[6] Report of the Thirteenth International Medical Congress, Journal of Laryn., Rhin., and Otol., November, 1900.

Anosmia may be congenital. In addition to the case reported by Zwaardemaker, Plazek[1] records a case of double congenital anosmia, and Jacques[2] mentions another.

The most frequent cause of anosmia is influenza, though it may occur in tabes, from the excessive indulgence in alcohol, tobacco, morphine, following the use of ether, or after injury to the fifth nerve. Cocaine anosmia has been recorded. Tresilian[3] reports a case of anosmia following a fall in a young woman, twenty-two years of age, in whom the sense of smell was absent for a year or more. The use of powerful antiseptics, the presence of ozæna or of pus, are all etiological factors in occasioning anosmia. To these hysteria may be added. The second or obstructive form of anosmia may be occasioned by atresia, deviations of the septum, hypertrophies of the mucous membrane, polypi, etc.

Symptoms. The symptoms of anosmia are complete or partial absence of the sense of smell, substitution at times of a disagreeable odor, headaches, vomiting, etc.

Prognosis. The prognosis depends entirely on the cause and the duration of the anosmia. M. MacKenzie believes anosmia to be incurable if it has existed for two years. D'Aguano,[4] however, reports a case of cure after the anosmia had existed forty years.

Treatment. In the obstructive form these should be removed. For the hysterical state Bookaert[5] advises suggestion. The tabetic cases are incurable. Small doses of strychnine have been applied to the nasal mucosa, and applications of the galvanic current have been made.

Parosmia. Perversion of smell, the substitution of one odor for another, occurs occasionally, the odor substituted being usually a disagreeable one, differing in this to perverted conditions in the eye and ear. The color blind have pretty colors substituted for sombre ones; the singing of birds often accompanies tinnitus, while the parosmic subject smells odors that "cry out to heaven," and, as in the former conditions, the perversion is noticed only by the individual sufferer—if others noted the odor complained of it would not be parosmia.

Parosmia may be occasioned by decayed teeth, decayed matter in the tonsillar crypts, disease of the accessory sinuses, affections of the nasopharynx, or none of these may be present. Noquet[6] records two cases where an odor of decayed animal matter followed an attack of coryza. Among the insane and in epileptics, parosmia is of frequent occurrence. Among the greatest sufferers are those who have hysterical parosmia. In a case of this latter variety under the writer's care, a young man insisted on the presence of a vile odor which emanated from his nose. Although the writer could never detect it, the patient insisted that his employer did, not from anything the latter ever said, but "the way he looked at him." The constant fear of being discharged because his presence had become unbearable, and the dread of being shunned by his associates, made him constantly miserable and a most unhappy individual.

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[1] Berl. Klin. Wochenschr., No. 51, 1899.

[2] Rev. hebdom. de Laryngol., December 9, 1899.

[3] Journal Laryn., Rhin., and Otol., December, 1899.

[4] New York Medical Journal, May 4, 1889.

[5] Bookaert. Ann. de la Soc. de la Med. de Gand., 3 Fasc., 1900.

[6] Soc. Centralé de Médecine du Nord., December 9, 1898.

When parosmia accompanies or follows anosmia, as occasionally happens, after influenza, Myers[1] having recently reported such a case, the prognosis is apt to be good.

Treatment consists in diligent search for and removal of the cause.

Anæsthesia is comparatively rare, usually one-sided and associated with hysteria. In partial central or peripheral paralysis of the trigeminus it is of more frequent occurrence. If the trigeminal paralysis is complete there is, in addition, a loss of sensation in the external portion of the nose. Anæsthesia is indicated by the absence of sensation either to vapors or touch; sneezing is not occasioned by irritants, nor is there any overflow of lacrymation.

Hyperæsthesia is common, variable in individuals, some suffering with the slightest touch. Remedies that soothe most individuals aggravate these. Thus the application of the suprarenal extract, of menthol, and of cocaine, that ordinarily give great relief, is followed by pain, sneezing, hypersecretion, excessive lacrymation, headache, and insomnia. There are no means of being forewarned as to these idiosyncrasies. Hyperæsthesia is common during pregnancy. Korn[2] has recently reported a case of unusually severe symptoms. Without any recognized cause, a woman in the last month of her third pregnancy was affected with severe and almost incessant convulsive sneezing, which lasted for four days in spite of the use of morphine, chloroform, amyl nitrite, bromine, and trional. During the ensuing five days there was but trifling abatement; but then labor pains set in and spontaneous delivery occurred. The quantity of liquor amnii was very large. After parturition the woman sneezed no more. Ball[3] in a study of 112 cases found one-half of them due to asthma, evenly distributed between males and females between the ages of twenty and forty years.

Hyperæsthesia shows itself principally in paroxysmal sneezing, and may become excessively annoying by its continuance. In its mildest form it is occasioned by exposure to bright sunlight or particles of dust and the pollen of plants. Certain drugs produce it in susceptible individuals. When it occurs at certain seasons of the year it is known as "rose cold." The mucous membrane is apt to be engorged or œdematous during the attack, and sometimes exfoliation takes place. In addition to the general symptoms of obstruction, as occurs in acute rhinitis, there is much depression, without, however, any accompanying rise in temperature.

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[1] Laryngoscope, May, 1901.

[2] Frauenarzt, No. 12, 1900.

[3] London Lancet, February 11, 1899.

The internal administration of quinine, arsenic, and extract of belladonna, and the local application of the suprarenal extract, followed by menthol in a 2 per cent, solution of liquid vaseline, will usually give great relief. Cocaine should be mentioned in order to be condemned. It but adds to the torture of the patient in giving relief for a few moments, only to lapse into former conditions of obstruction, really accentuating them. The cocaine habit may readily be formed by these sufferers. Fortunately we have in the suprarenal extract and its preparations a thoroughly efficient substitute without its dangers. It was in connection with the effect of the suprarenals in these maladies that the writer stated that "if the effect of this extract never served another purpose than the lasting relief following its use in these conditions, it still remained a most valuable addition to our list of remedies." In some cases the application of the galvano-cautery to the sensitive areas of the nasal membrane will be followed by cure of the hyperæsthetic condition.

Paræsthesia is usually associated with some remote condition, such as hemorrhoids, entozoa, lymphoid hypertrophy, aural disease, etc.

It presents itself in the form of itching. The removal of the cause cures the affection.

Neuralgias of the mucous membrane of the nose are of rare occurrence except in connection with facial and trigeminal neuralgias.

Hysterical nasal insufficiency occurs rarely, its chief symptom being the alleged inability to breathe through normal nasal passages. Lermoyez[1] has recently recorded such a case.

Paralysis of the levator alæ is generally associated with other forms of facial paralysis. It occurs usually as a one-sided sinking-in of the ala, occasioned by the contraction of some of the fibres of the levator muscles and laxness of the others, and is to be found in the individual of the highly neurotic, anæmic, and myopic type, and generally in the male. There is to all appearance ample room for ordinary purposes, but the individual believes that surgical relief is required, that no one suffers as he does, and is happiest when he can find some sympathizer to whom he can unfold his tale of woe. He soon becomes known as a nose-hypochondriac, and spends his time making the life of the rhinologist unhappy.

The use of a vulcanite tube worn at night, strychnine and bromides internally, and the assurance that the woes of this life are not all his, are the indications for treatment.

Disturbances of Secretion.

Nasal Hydrorrhœa. An excessive flow of secretion from the nasal mucosa without pathological changes may be due to any one of a variety of causes. Lermoyez[2] believes that spasmodic hydrorrhœa is merely an accident of arthritism, and frequently alternates with the other phenomena, diarrhœa, migraine, etc. Nitkin[1] regards most cases of hydrorrhœa to be due to paresis of the vasomotor nerves of the nasal mucosa, often reflex, as from adenoids. Among the causes are cold, winter weather, excessive lacrymation, and emotional excitement, errors in diet, uric acidæmia, and diabetes. Kyle has collected 27 cases, to which Abate[2] has added another.

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[1] Presse Médicale, January 25, 1899.

[2] Ann. des Mal. de l'Or., etc., Paris, July, 1899.

After the affection has lasted for some time the mucous membrane appears soggy; in the early part of the affection there is no visible change. The discharge may be one-sided, but is usually bilateral. It may appear with regularity at certain hours, usually in the morning, and not occur for the remainder of the day. The condition is to be differentiated from cerebro-spinal rhinorrhœa, and will be considered under the heading of the latter affection.

The **prognosis** is good, depending entirely on the cause.

Treatment. Treatment consists in the internal administration of atropine for the hypersecretion, and strychnine for the vasodilators; massage of the nasal mucosa, the application of solutions of protargol. Insufflation of drying powders, as zinc preparations, to which menthol or boric acid has been added, have their value in appropriate cases where no discernible cause exists. The malarial, rheumatic, and lithæmic causes need proper treatment, and the errors of diet corrected.

Cerebro-spinal Rhinorrhœa. The spontaneous discharge of cerebro-spinal fluid from the nose is of infrequent occurrence. St. Clair Thomson[3] has collected a number of cases in a recent monograph, and T. Fisher,[4] Scheppegrell,[5] Hektoen,[6] and Freudenthal[7] have each reported a case. That of Fisher occurred in a boy of four years of age. Hektoen's case is interesting in that what appeared to be a polyp was removed from the nose, but proved to be a portion of a meningocele. Cerebral fluid escaped from the opening.

This condition is due to an oversecretion of arachnoid fluid finding its way down through the perineural sheaths of the olfactory nerves. Increased cerebral pressure is always present; retinal changes occur with frequency.

The amount of fluid which escapes varies. It has been known to reach 3000 c.c. in twenty-four hours. It has an alkaline reaction, an average specific gravity of 1006, contains chlorides, albumin, and at times phosphates and sulphur salts identical with cerebro-spinal fluid.

Mental depression and headaches usually pre-exist; dizziness and one-sided anosmia are apt to occur, the head symptoms ceasing when the flow begins. The latter is constant and one-sided. An early diagnosis is essential in order that we may prevent meningeal affection through the nose. The chemical examination of the fluid, its constancy and one-sided flow will help to differentiate it from nasal hydrorrhœa.

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[1] Journal Laryn., Rhin., and Otol., July, 1899.

[2] Bolletino delle Malati del Orecchio, November, 1900.

[3] Laryngoscope, November, 1898.

[4] British Medical Journal, November 18, 1899.

[5] Journal American Medical Association, February 26, 1898.

[6] Indiana Medical Journal, February, 1900.

[7] New York Medical Journal, March 31, 1900.

Treatment is of no avail.

Reflex nasal cough occurs in a large percentage of individuals on the introduction of applications to the mucosa where it is occasioned by pathological changes. These latter should be attended to.

Sternutation. Excessive sneezing may be acquired or congenital. It may be occasioned by disease of the brain or medulla, of syphilitic origin or not, and in certain conditions of the insane.

NEUROSES OF THE PHARYNX.

The posterior nares is the most sensitive portion of the pharynx. The uvula is not at all sensitive to warmth, as seen in laryngoscopic examinations, etc.

The sensation of the pharynx may be totally or partially diminished, and this is termed—

Anæsthesia of the Pharynx. It occurs most frequently after diphtheria and severe inflammatory disturbance in the pharynx; it may also be associated with epilepsy, gummatous tumors, multiple sclerosis, and pseudobulbar paralysis. It may occur at the menopause, in cholera, dysentery, and diabetes, and following the use of morphine, cocaine, menthol, ethyl chloride, etc. It may be one-sided or bilateral. partial or complete.

When the pharynx only is involved and the cause a minor one, the prognosis is good. Where the larynx is involved there is imminent danger to life from choking, or the entrance of small particles of food into the bronchi may result in catarrhal bronchitis or pneumonia, and here the prognosis is bad.

There is apt to be numbness in the pharynx, the principal complaint being a cough during every act of deglutition. Fluids are swallowed slowly, and ofttimes the subject has learned to swallow in the prone position.

It is of the utmost importance that foods should be carefully selected, especially where the larynx is involved. The mouth should be thoroughly cleaned and all particles of food removed after feeding. If the œsophageal bougie is used, talking should be encouraged, and the respiration should be watched when the tube is occluded, before food is poured in. The writer saw a case of anæsthesia of the pharynx and epiglottis in which raw oysters were partaken. An oyster entered the larynx, and although but a few minutes elapsed before he saw the case, life was extinct; all efforts to resuscitate failed. In simple cases the faradic current and strychnine given internally will benefit.

Hyperæsthesia of the Pharynx. Excessive sensibility of the pharynx may be due to the inhibition of excessively hot foods, chewing of tobacco, excessive use of alcohol, nasal obstruction causing mouth-breathing, congestion, the result of venous stasis. It occurs in valvular heart disease, in hysteria, and in meningitis. It is associated with pain radiating to both ears, nausea, and vomiting.

The pain is sometimes very severe, is intermittent, and may assume the regularity of a quotidian or tertian. Except when due to local irritants, there is no congestion present.

It is very important that the cause should be carefully sought, and it should be differentiated from rheumatism and syphilis. A rheumatic history will aid materially for the former condition; but a specific history is not so readily obtained, not so much because of untruthfulness on the part of the patient, but because pharyngeal infiltrations are among the very late evidences of the disease, and often the patient is entirely unaware of the presence of syphilis. This is especially the case in late hereditary syphilis, seen now and then. The author was recently called upon to treat a lady who had been under the care of a colleague for nervous sore-throat, and all the anodynes given had no effect. A very careful pharyngeal examination showed two bands on either side of the posterior pharyngeal wall, well hidden by the anterior pillars. These bands were puffy and of a dark-red color—there was no destruction of tissue—they seemed to present the picture of gummatous infiltrations and large doses of iodide and mercurial inunctions cured her in a week. It was subsequently ascertained that a sister and a brother of the patient had evidences of hereditary syphilis.

Where hyperæsthesia is intermittent quinine administered internally is of value. The cause ascertained, recovery follows its removal. It is especially essential that cocaine should not be used here. Its effect is too evanescent, and it is withal too dangerous a drug to use.

Paræsthesia of the Pharynx. A perverted sensation of the pharynx is rare, *per se*. It occurs in the climacteric period, in hysteria, and hypochondria, following the use of cocaine, menthol, and chloral, and subsequent to the swallowing of foreign bodies. There is complaint of the presence of a thread, a hair, or foreign body, or a sensation of sticking and burning. These affections occurring largely in the neurotic, their fears become greatly magnified and their imaginations lead them to expect the worst. Almost the first question is whether they have cancer or tuberculosis. Sometimes the affection appears very suddenly, perhaps even during deglutition, and then a foreign body is at once supposed by them to have lodged. Patient search fails to reveal any foreign body. A rheumatic history is negatived.

The **prognosis** is good, except, perhaps, in the purely hysterical. In these suggestion has been of value. A case occurred in one of our clinics—the patient insisted that an orange-pit had lodged a fortnight previous to his visit. He stated that he had seen several physicians who could not find it, and he knew it was there, because he felt it. A most exhaustive examination under cocaine anæsthesia failed to find it, and he was asked to come the next day for a further examination. On his second visit a pill of soft bread had been previously placed between the teeth of a MacKenzie forceps and the closed forceps was introduced into the sinus pyriformis and held there a few minutes. When it was extracted and shown the patient he explained: "That is it!" and his pain ceased, never to return.

Motor Disturbances.

Pharyngeal paralysis is of frequent occurrence as a sequel of diphtheria, and it may occur in connection with cerebral hemorrhage, tumors of the brain, pseudoparalysis and true bulbar paralysis, disease of the medulla, and tabes.

Paralysis of the deglutitory muscles may be present in extradural abscess and periphlebitis of the sinus in the course of typhoid fever and in influenza. It may be unilateral or bilateral, alone or associated with paralysis of the larynx and of the tongue and lips, as in glossolabial pharyngeal paralysis.

At first speech is interfered with, and deglutition becomes impaired. Puffing up the cheeks or blowing out a light becomes impossible; fluids come through the nose when swallowing is attempted, and, where there is a perforated membrana tympani, through the ear.

Pharyngeal examination shows the affected side drooping and smooth, while the normal side is well drawn up and corrugated; reflex is absent to touch on the affected side. Where the tongue is affected bits of food lie at its base.

The **prognosis** depends on the cause. The **treatment** is the same as outlined in the subdivision of anæsthesia of the pharynx.

Spasm of the Pharynx. This has been called "pharyngeal tenesmus" by Lennox Browne,[1] and Lambert Lack[2] has made use of the term "pharyngeal nystagmus" for a form of this affection.

Spasm of the pharynx is occasioned when pharyngeal or laryngeal examination is attempted, and is readily controlled by means at our command, like cocaine, ice, the bromides, etc. In hydrophobia and in those who fear hydrophobia the spasm may give rise to intense suffering. In true hydrophobia the very sight of water causes violent spasm. It must be differentiated from globus hystericus. General anæsthesia may be required to relieve the suffering patient; usually the bromides and chloral per rectum or hypodermics of morphine suffice.

Clonic spasm occurs occasionally. Semon[3] has recently reported a case of clonic spasm of the palate, pharynx, and larynx in a woman, aged thirty years. About four clicking sounds were clearly heard by him in each second; this was constant, and was produced by the rapid vertical movements of the soft palate associated with similar movements of the floor of the mouth. He says that speculation as to the cause is idle. Lambert Lack reported the case of a female, aged nineteen years, who complained of phlegm in her throat. Examination showed a rapid twitching of the posterior pharyngeal wall, which seemed to be rapidly jerked to the left side and then relaxed. The movements were rapid and unceasing, 150 to the minute, and not quite regular in extent or time. They resembled nystagmus, and were quite different from choreic movements. The superior and middle constrictors seemed to be affected, but not the palatal muscles. The affection remained constant for two months. He was able to find eight cases in the literature. He believes the affection to be due to gross lesions of the central nervous system, cerebellar tumors, etc., or reflex, and apparently due to postnasal catarrh. In his own case treatment to the posterior nares was followed by cessation of the movements. Alcohol, mercury, and lead are given as etiological factors.

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[1] Archives of Laryngol., February, 1891.

[2] Laryngoscope, June, 1898.

[3] Journal of Laryngol., Rhinol., and Otol., March, 1901.

The enumeration of neuroses of the throat is not complete without mention of—

Hysterical Dysphagia. This affection occurs more frequently in women than in men, and may appear in children. It is best described as a partial or complete inability to swallow, without known pathological causes, or, by reflex, from so trivial a cause that it must be considered hysterical in origin.

There is no pain in swallowing, a sound passes readily, and the attack is usually sudden in onset and not continuous. Solids are often swallowed better than liquids.

The **prognosis** is good as a rule.

The **treatment** consists in rest of the parts, rectal alimentation, if necessary, antispasmodics, and removal of any exciting cause.

NEUROSES OF THE LARYNX.

Sensory Neuroses.

Hyperæsthesia, excessive sensibility of the larynx, occurs in bronchial asthma, hysteria, neurasthenia, from excessive smoking, in alcohol habitués, during menstruation, pregnancy, at the climacteric, and sometimes is an early symptom of tuberculosis.

It is evidenced by pain, usually unilateral and intermittent in character, sometimes very intense. It is very persistent, and the tendency is toward recurrence. It occurs in both sexes in early and middle life. Gottstein reports a case in which the pain on talking was so intense that phonophobia existed.

Treatment. Treatment should be constitutional and local. Cocaine should not be administered. The bromides, quinine, hot or cold applications as they are best borne by the patient, sprays of the suprarenal extract, and menthol in liquid vaseline, etc.

Anæsthesia. Partial or complete loss of sensibility of the larynx has the same etiological factors as that of the pharynx; both coexist, as a rule, and the treatment is the same. Except when due to syphilis or diphtheria, the prognosis is bad. The danger of particles of food entering the larynx must never be lost sight of.

Paræsthesia. A perverted sensation in the larynx may be due to local or more remote inflammatory conditions, such as the presence of hypertrophied lingual tonsils, adenoids, follicular pharyngitis, and foreign bodies in the ear. It has been known to occur from so remote an organ as the uterus. The removal of uterine polypi has been promptly followed by the cure of the laryngeal symptoms. It also occurs at the menopause.

The **prognosis** is good.

Treatment. The cause carefully sought and removed will usually be all-sufficient.

Neuralgia of the larynx has been recorded. It is rare, and the indications are for anti-rheumatic and anti-neuralgic treatment.

Motor Neuroses.

Spasm may occur in the adult, as it does in children. It may affect any of the laryngeal muscles, and when the abductors alone are affected there is generally a paralysis of the adductors present. Mild spasm is occasioned by the entrance of food into the larynx, inhalation of irritant vapors, as chloroform by gaslight, burning sulphur, etc. Children have an especial tendency to attacks, which generally occur between the second and seventh years of life. It may also occur in the newly born. Variot and Hodour[1] mention stridor in newborn infants. Stamm[2] records two cases of congenital stridor. Strshelbitzki[3] presents three cases. Variot was enabled to perform an autopsy on a child of one year who had constant stridulous breathing. He found the epiglottis elongated, both aryepiglottic folds hypertrophied, and a very narrow glottis was formed. The condition is evidently due to an embryonic state of the epiglottis which has not yet fully unfolded.

Rhachitis stands pre-eminent among the causes of this affection in children; hydrocephalus, anæmia of the brain and membranes; tetanus, dentition, large and caseous bronchial glands, inflammations in the mucous membrane of the air passages, digestive disturbances, entozoa, excessive crying, lymphoid hypertrophies, etc., are further causes of this affection. Certain children have predisposition to attacks or hereditary tendencies, while age, sex, errors in diet, and unsanitary surroundings may be causal factors. Semon[4] reports the case of a child in whom the spasm was due to a thrombosis of the longitudinal sinus.

Spasm may be occasioned by the use of sprays. Boyd[5] reports a case of tetany and spasm of the glottis from chloroform administered to a child with papillomata. Ganghofner[1] found 61 cases of marked tetany recorded in 105 cases, and he concludes that the association of spasm and tetany is the rule. Baginski[2] mentions enlargement of the thymus as an etiological factor.

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[1] Presse Médicale, November 7, 1900.

[2] Kinderh., No. 28, 1900.

[3] Med. Obvs., August, 1900.

[4] Heymann's Handbuch der Laryn., 1, 7, 1897.

[5] Canada Lancet, July, 1901.

In mild cases there is, without pre-existence of laryngeal symptoms, a sudden attack of long-drawn inspiration distinctly heard in the room; after a few such inspirations there is complete subsidence. In severer cases the attacks always appear suddenly; respirations become more and more severe; there is a gasping for breath; an anxious expression, and even cyanosis, with evident suffering. The head is bathed in perspiration, eyeballs turned up, and alæ nasi widely distended. In still severer cases there is tonic spasm of the extremities, loss of consciousness, and cardiac weakness, death following either from such weakness or from suffocation.

The attack usually exhausts itself; there is a long-drawn inspiration with a crowing sound, a longer period of rest, followed by less noisy and obstructive inspirations, the color returns, the pulse becomes stronger, and the attack is over for the time being. In some instances there is no recurrence, but usually there are recurrences.

The suddenness of onset, absence of temperature, and the result of bacteriological examination make the differential diagnosis from diphtheria not so difficult. From a catarrhal laryngitis or a foreign body in the larynx the diagnosis is not so easy. In one case the writer[3] records that of a child in whom tracheotomy revealed a foreign body on a line with the true vocal cords, which was only suspected before operation.

Unless the attack is due to direct cerebral irritation, the prognosis is generally good. M. MacKenzie claims that the greater the interval between attacks, the better the prognosis. Death occurs either from asphyxia, from suffocation, cardiac exhaustion, or cerebral compression may occur from transudation between the cerebral membranes and in the ventricles.

Treatment. PROPHYLACTIC. Rest, bromide of potassium internally, regulating the diet, small quantities of food at a time. The rooms should be well ventilated, the child kept out-of-doors in clear weather, and adenoids or tonsils, if present, should be removed.

For the attack Holt advises the following:

Chloral hydrat.,	5.0
Kalii brom.,	3.0
Ammon. brom.,	2.0
Aq. cinnamom.,	64.0—M.

Sig. Teaspoonful every twenty minutes if not relieved.

This dose for a child of seven years.

Frerichs gives:

Ext. bellad.,	0.27
Liq. ammon. anisat.,	2.25
Aq. dist.,	13.0—M.

Sig. Ten to twenty drops every three hours for the attack.

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[1] Münchener med. Wochensch., No. 44, 1899.

[2] Internat. Clinics, April, 1899.

[3] New York Eye and Ear Infirmary Reports, 1899.

Inhalations of steam, slaking lime, emetics, sinapisms are all employed during the attack. Both Sevestre[1] and Richardiere[2] mention laryngeal spasms requiring tracheotomy or intubation. Baginski[3] gives phosphorus internally with bromides or musk.

Laryngeal Spasm in Adults. While by no means of rare occurrence, it is much less frequent than in children. Laryngeal spasm may be central in origin, as in hysteria, chorea, and epilepsy. In this form there is some irritation of the branches of the recurrent nerve with an excess of irritation to the adductor muscles.

Tetanus, hydrophobia, and tabes are etiological factors. It may occur as a reflex from various organs, the intestinal tract, intranasal disease, and the sexual apparatus. Brose[4] reports two cases, one due to carcinoma of the lower end of the œsophagus, and another which subsequently developed tuberculosis. The writer treated a young man of tubercular family history, who possessed a highly neurotic temperament and who had repeated daily and nightly attacks of laryngeal spasm of short duration. There were no discoverable lesions in the pharynx, larynx, or pulmonary apparatus. Some fibrinous rhinitis existed. The attacks ceased after a few weeks. A few months later tuberculosis developed. The pressure of intrathoracic tumors and of aneurisms, if the nerve is not entirely obliterated, causes spasm. Dundas Grant and Mr. MacIntosh[5] relate a case of a female whose glottic spasm seemed to be due to an acute lingual tonsillitis. McCardie[6] records a case of laryngeal spasm during the administration of ether, due to a compensatory mitral stenosis.

Spasm may be phonatory, deglutitory, or respiratory. The attack is sudden in onset and similar to those occurring in children; general convulsions do not, however, accompany the attack in adults.

The **diagnosis** is readily made with the laryngoscope. The prognosis, except in those due to central lesions, is good.

Treatment. Semon advises rest during the attack, to have the patient hold his breath, and to breathe rapidly with closed mouth. Moritz Schmidt advises pressure on the tip of the nose while the patient breathes deeply. Chloroform inhalations or tracheotomy or intubation may become necessary.

Chorea of the Larynx. This may occur independently, but it is usually associated with chorea elsewhere. Onodi[7] prefers the term choreiform movements, being opposed to that of chorea of the larynx. It usually manifests itself by a constant barking noise, harassing to the patient and to those about him.

Treatment. The treatment is the same as applies to chorea elsewhere: rest, arsenic, etc. The prognosis is generally good.

Phonatory Spasm. An inco-ordination of the muscles of the larynx, phonation failing, due to a more or less complete closure of the glottis, exists either alone or with functional inspiratory spasm of the glottis. Reflex causes must be sought for and remedied.

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[1] Soc. Méd. des Hôpitaux, March, 1899. [2] Bullet. Méd., February, 1899. [3] Loc. cit.

[4] Journal American Medical Association, June 22, 1901.

[5] Journal Laryn., Rhin., and Otol., April, 1901.

[6] New York Medical Record, February 3, 1900. [7] Arch. f. Lar., 1900, Bd. x. p. 32.

Stammering. Few maladies to which flesh is heir cause quite as much unhappiness as does the stammerer's inability to express his thought. From time immemorial noted men have been thus afflicted whose "nervous dread and sensitive shame freeze the current of their speech; they stand impotent of words, travailing with unborn thoughts."

For some unknown reason their treatment has hitherto been principally left to the charlatan, who, by some secret method, tries to cure every case on a similar plan, and ignominiously fails. The treatment is logically that which the laryngologist only can indicate.

Some writers have laid stress on the great difference existing between stuttering and stammering. It seems simplest to view stuttering as the prodrome of stammering, as indicated by Makuen.[1] Among recent writers, Pluschowski[2] says that most defects of speech, and especially stammering, belong to the curable neuroses. Holger Mygind[3] says that stammering must appear as the expression of a neurosis which is etiologically related to the so-called neuropathies of degeneration, to which diseases like epilepsy, hysteria, neurasthenia, chorea, and insanity belong. This relation is the stronger, as many of the latter diseases are found in the family history of stammerers. The latter, too, have some of the stigmata of the former. Stammering occurs at certain ages, in males from two to four years of age, and has this in common with hereditary neuropathies, that the occasional causes are far behind the remote. This is not true in every case, for many stammerers have no hereditary predisposition.

Stammering is the inco-ordination of the three mechanisms of speech: the respiratory, the vocal, and the oral. In the medulla oblongata is located the centre which presides over the co-ordination of the movement concerned—the basal phonic centre—and the faulty mechanism of one results in a faulty action of all. This co-ordination in the normal voice production has been likened by Wyllie[4] to the pleasing tones produced on the violin with the bow-hand acting in proper unison with the fingers of the other hand along the strings. Klindworth[5] used the accordion as his simile.

In a report on stammering from the standpoint of military duty, Chervin[6] states that about 1000 are yearly declared unfit for duty in France because of this affection.

Makuen[7] in a study of 200 cases found 17 per cent. due to involuntary imitation of others, 15 per cent. due to fright, 8 per cent. due to an injury, and 6 per cent. to having been ill-used at home.

Fully 95 per cent. are males. It has never been explained why this should be. Potter[1] believes that females are exempt because they are under the gentle guidance of their mothers, and soon overcome any hesitancy in speech. For the man-child, he draws the picture of the little lad stammering in fear before his wrathy male progenitor, who towers over the former with angry mien and uplifted rod, ready to trounce him soundly at the first indication of hesitancy in speech. The trembling urchin, kept in a state of terror, shame, and even anxiety from the very mental expectancy and fear, soon becomes a confirmed stammerer, when gentle measures would have cured him.

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[1] Philadelphia Medical Journal, March 30, 1901.

[2] Russ. Arch. Patol., vol. vi., 1898.

[3] Arch. f. Lar. and Rhinol., Bd. viii., 1898.

[4] The Disorders of Speech, 1894.

[5] Stuttering; How to Cure It.

[6] Bulletin Méd., September 28, 1898.

[7] Therapeutic Gazette, September 15, 1897. Philadelphia Medical Journal, February 2, 1901.

Any obstruction to respiration in the nose or in the pharynx should be removed, tongue-tie cut, and muscles requiring surgical attention should be cared for. The factor creating the hesitancy of speech should be discovered, and treatment for its relief instituted.

Under proper care physiological voice sounds are persistently taught, the extrinsic muscles brought into proper play, and every psychological as well as physiological method employed to restore the co-ordination. No mimicking should be permitted, nor force used. With gentle measures, following these lines, cures may be anticipated in a majority of cases.

Laryngeal Vertigo, also known as ictus laryngea and laryngeal epilepsy, is of unusual occurrence, but by no means a rare disease. Garel and Collet[2] record 23 cases, while Chazalon,[3] Fayolle,[4] and Ch. Bernard[5] have reported 9 more.

As etiological factors, Moncorge[6] found 18 due to asthma, Tilly[7] and Meyges[8] found excessive smoking responsible, and Percepied[9] found 8 out of 12 due to excessive smoking, the others to smoking and hypertrophy of the nasal mucosa. Adler[10] reported a case due to elongated uvula. Hypertrophy of the lingual tonsil may act as a cause, as also tabes and bulbar paralysis.

Nearly all of the recorded cases occurred in males between the ages of forty and forty-five years.

The attack is occasioned by some peripheral irritation of the superior laryngeal nerve. This irritation is directed to the cardiac and pulmonary centres rather than to the cortex. As a result of the cardiac and pulmonary disturbance, with the mechanical irritation causing cough, alterations in the cortical circulation occur, and the attack follows.

The attack begins with a tickling in the throat, causing cough, the face becomes congested, and the patient falls unconscious to the floor, or, if seated, the head sinks forward on the chest. After a few seconds he arises pale, and proceeds with his interrupted vocation, remembering the cough only, but not the loss of consciousness. While the attack simulates an epileptic attack, there are few, if any, muscular spasms, the tongue is not bitten, there is no subsequent nausea, no involuntary urination, nor defecation, and no headache. Laryngeal vertigo occurs in advanced years, and is always of short duration.

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[1] Speech and its Defects, 1882.

[2] Ann. des Malad. de l'Or., 1894.

[3] Thèse de Lyon, 1896.

[4] Lyon Méd., 1896.

[5] Provence Médicale, August 13, 1898.

[6] Annal. des Malad. de l'Oreille et du Lar., etc., February, 1900.

[7] Journal Laryn., Rhin., and Otol., April, 1901.

[8] Monatschr. f. Ohrenh., No. 9, 1899.

[9] Normandie Medical, February 1, 1899.

[10] New York Medical Journal, February 12, 1892.

The **prognosis** is good. The **treatment** is embodied in the search for and removal of the cause.

Laryngeal Paralysis, Hypokinesis. Any injury to a part of the motor tract of the larynx occasions paralysis. This may be functional or organic, one-sided or bilateral, complete or incomplete, affecting either phonatory or respiratory functions, or both.

To properly appreciate the conditions here existing, it will be borne in mind that the external or small branch of the superior laryngeal nerve alone contains motor filaments, and these supply the crico-thyroid muscle only, the other branches of the superior laryngeal nerve being exclusively composed of sensory filaments which supply the mucous membrane. The crico-thyroid receives motor impulses also from the pharyngeal branch of the pneumogastric. The other internal laryngeal adductors, abductors, and tensors are supplied by the inferior or recurrent laryngeal nerve. The vagus, running from the jugular foramen with the bloodvessels, dips into the thoracic cavity and gives off the recurrent laryngeal, which winds around the arch of the aorta on the left, and the subclavian artery on the right and returns to the larynx. (Plate XXXII.)

Regarding the manner in which paralysis actually occurs, Semon presented, in 1881, the theory that in all progressive paralyses in organic disorders the abductors are the first affected. In all functional disorders the adductors are affected practically alone. This occurred with such regularity that it amounted to a law. This view was combated by many, notably by Krause, and more recently by Grossman. Many have since recanted from their opposition. As each opponent presented his own views contrary to those of Semon, he promptly challenged each and every one, sturdily defending his own views. The general consensus of opinion to-day is in support of Semon.

DESCRIPTION OF PLATE XXXII.

ILLUSTRATIONS FOR LARYNGEAL PARALYSIS. (SCHNITZLER.)

FIG. 1.—Paralysis of both thyro-arytenoid muscles (interni).

FIG. 2.—Paralysis of the arytenoid muscle (transversus).

FIG. 3.—Paralysis of both thyro-arytenoidei interni and of the transverse.

FIG. 4.—Incomplete recurrent paralysis (right-sided), respiratory position. (Paralysis of the crico-arytenoideus posticus and of the thyro-arytenoideus internus on the right side.)

FIG. 5.—The same in phonation.

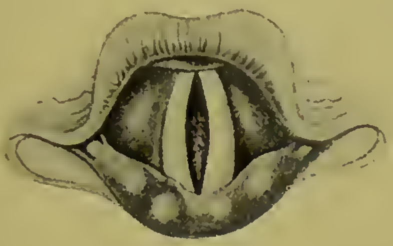
FIG. 6.—Paralysis of all adductors of hysterical origin.

FIG. 7.—Total paralysis of the recurrent, right-sided. The right vocal cord is fixed in the position called "cadaveric." In this figure the left normal vocal cord is seen extending over the median line toward the paralyzed right cord and the whole in the position of phonation.

FIG. 8.—Incomplete recurrent paralysis of both sides. (Paralysis of both the crico-arytenoidei postici; position of respiration.)

PLATE XXXII.

1



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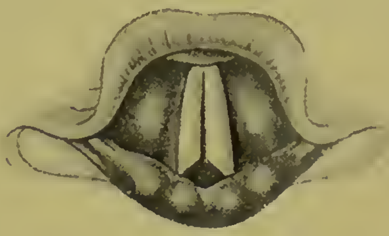

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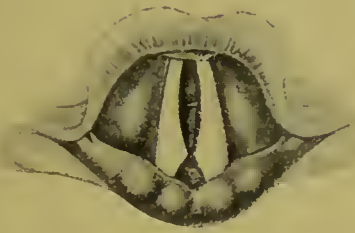

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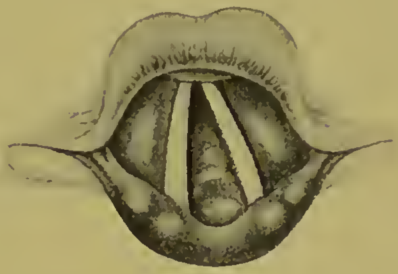

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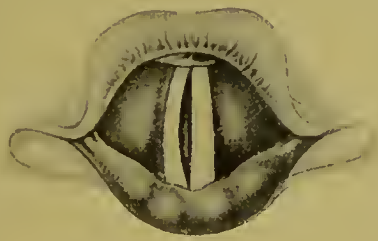

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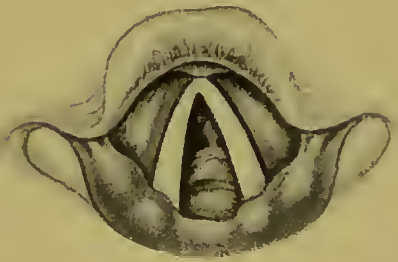

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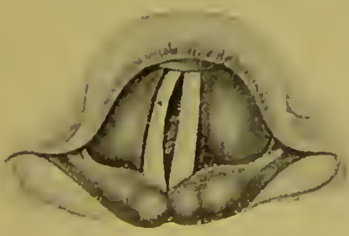

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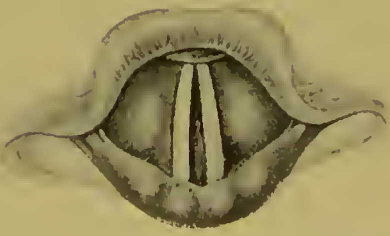

The term "cadaveric" position used to designate the fixed cord, is really a misnomer, Fein[1] having found ten different positions in the cadaver.

One of the most frequent of the central causes of laryngeal paralysis is tabes dorsalis. Touche[2] in a study of 40 tabetic patients found 12 with laryngeal crises. Other causes are syringomyelia, multiple sclerosis, cerebellar and bulbar lesions, and syphilis. Cases have been recorded in recent years due to foreign body in the larynx, bronchocele, cancer of the œsophagus, after measles, mediastinal tumors, influenza, aneurism of the aorta, typhoid fever, lead poison, pressure of enlarged glands, mental shock, primary laryngeal tuberculosis, and overuse of the voice and of the telephone. Ofttimes the laryngeal lesion is the first evidence of an aneurism or beginning tabes, and frequently the cause is unknown. Of the infectious diseases diphtheria is the most frequent cause. Lead, copper, antimony, phosphorus, arsenic, atropine, cocaine, or morphine may be factors in the causation.

Recurrent Laryngeal Paralysis. Both nerves may be affected, although it is very uncommon. The vocal cord assumes the rigid position for which the term "cadaveric" has been applied. In unilateral paralysis aphonia is first present, but the normal cord soon makes a large excursion to its maimed fellow, and phonation becomes possible. Dyspnœa is not present, except when bilateral abductor paralysis exists. No amount of forced inspiration will make the paralyzed part move, and it is this fixation that is depended upon for diagnosis. The narrow chink that is left in this form of affection is always the same, while in hysteria the opening is larger.

Unilateral abductor paralysis occurs frequently without dyspnœa or dysphonia. Its presence is an indication for a careful search for the cause.

In bilateral abductor paralysis the voice is present, but the grave symptom is dyspnœa. Paralysis of both posterior crico-arytenoid muscles, if complete, places the patient in immediate danger of death by suffocation. Wright[3] believes that the sudden deaths in cerebral apoplexy might be explained by the existence of this form of paralysis. Laryngoscopic examination shows the cords to be almost entirely approximated, a small slit fully existing between them.

Tracheotomy is frequently necessary, and some laryngologists consider this the only procedure. Semon would leave it to the patient to decide to risk the danger of suffocation, or to wear a tracheotomy tube. N. L. Wilson[4] suggests intubation. Joachim,[5] after tracheotomy, performed a thyrotomy and removed both vocal cords, with restoration of function. J. Solis Cohen[6] says that if tracheotomy be refused by the patient he should be urged to always carry a tracheotomy tube with him to show his physician if the emergency arises; by this means life has been saved in two or three instances.

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[1] Wien. Klin. Wchn , 1900, No. 24.

[2] Presse Méd., August, 1899, No. 69.

[3] American Text-book of Diseases of the Eye, Ear, Nose, and Throat.

[4] Laryngoscope, September, 1900.

[5] Ibid.

[6] Ibid.

Injections of bichloride of mercury have been valuable when due to syphilis. G. Geronzi[1] believes that if the recurrent laryngeal nerve could be resected, if there is no hope of restoration of the function of the posterior crico-arytenoid muscle, that the danger of suffocation would be averted.

Paralysis of the Adductors of the Vocal Cords (Crico-arytenoidei laterales). Bilateral paralysis has as its chief etiological factor hysteria. It is sudden in its onset, without symptoms of constitutional disturbances, save those of hysteria, its main symptom being aphonia, more or less complete. Laryngoscopic examination shows the cords far apart as in forced inspiration and apparently immovable. Occasionally but one side is affected, and a few such cases are recorded. While hysteria is the main element, reflex causes may exist. The aphonia comes without warning and remains persistent at times.

Semon believes that the largest percentage of cases of hysterical aphonia may be cured at one sitting, one of the electrodes being placed on the interarytenoid folds, using the faradic current. The application should be energetic and lasting and the sitting continued until the voice has returned. Suggestion has been followed by good results. The writer saw a cure result from an application of a cotton swab in a case of over six months' duration. In another instance a young girl was brought to me with the history of sudden loss of voice following an accidental fall. She travelled several miles to come to my office, and was well in every other way. There was so much pharyngeal irritation that it was deemed best to spray her pharynx with cocaine. As she saw the spray apparatus approach and point at her, she gave a startled look and said in a loud voice, "Oh! my God. What's that?" She was cured. When faradization is employed, it should not be used too strong, nor should we toy with it.

Paralysis of the central abductor, the arytenoideus muscle, occurs alone at times. Except for a triangular space posteriorly, the cords are in apposition in their entire length. The chief symptom is aphonia and the cause hysteria.

Paralysis of the superior laryngeal nerve, causing paralysis of the external tensor, the crico-thyroideus, and the internal tensor, the thyro-arytenoideus internus, is of rare occurrence. It may be caused by traumatism or diphtheria, and may be associated with paralysis of the recurrent branch, when it becomes a very dangerous affection. Total anæsthesia of the larynx may be occasioned, and then there is need for great care as to the food administered.

Paralysis of the thyro-arytenoidei muscles is of frequent occurrence. Any inflammatory process or overuse of the voice may occasion it. Hoarseness and aphonia to a mild degree exist. The laryngoscopic examination shows an elliptical opening.

The **prognosis** is good. Rest, iron to the larynx, and soothing applications result in complete recovery.

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[1] Riforma Medica, Palermo, July 6, 1899.

CHAPTER XXIV.

EXTERNAL DEFORMITIES OF THE NOSE; CLEFT PALATE.

By F. E. HOPKINS, M.D.

In treating the subject of deformity of the nose a preface might well be written upon *prevention*, so large a percentage of deformities is caused by displacement or fracture which failed to receive proper attention at the time of the accident. This negligence may be due to lack of appreciation of the damage done. The swollen condition of the nose sometimes renders it difficult to determine the amount of displacement or the ultimate interference with respiration; moreover, the fact that an injury to the nose does not usually imperil life nor seriously impair the individual's earning capacity almost unconsciously lessens the importance attached to its treatment. The accident, however, for several reasons demands most careful attention, and that early. Circulation in the nose is most active, and after displacement from fracture the fragments quickly and firmly unite in their vicious position, leaving permanent deformity. The nose is so prominent a feature, and its symmetry so large a factor in a pleasing facial expression, that in case of deformity the patient is subject to a degree of constant mortification which, apart from its subjective side, amounts to a tangible handicap in the struggle for existence. This mental suffering is more acute, perhaps, in women and children, and often is not amenable to any relief from philosophy, as the victim greatly exaggerates the effect of even slight variations from symmetry. Not only is it important to correct the external injury for what may be called cosmetic effect, but the interior of the nose must receive attention at the same time. The displacement of the septum causes an occlusion of one or both fossæ, with consequent interference with nasal respiration. The proper reposition of the septum aids in securing symmetry and stability for the injured organ, as well as restores normal respiration. Ether anæsthesia should be resorted to if there is the least doubt as to whether the parts are properly replaced, and, if the case is at all serious, the use of an anæsthetic might well be recommended as a routine practice. Deformities of the nose are amenable to satisfactory correction if seen early. Fracture of the nasal bones is often but a displacement along the lines of articulation with each other and with the nasal process of the superior maxillary bone. The case of a friend, Dr. B., who sustained a "fracture" is here in point, furnishing a typical case of displacement, and showing with what ease it may be corrected. The doctor is an enthusiastic basket-ball player, and while playing received a heavy blow upon the dorsum of the nose, displacing it bodily to the right. The accident was attended by severe pain and profuse bleeding. In about an hour reposition was effected by a confrère, the parts returning to position with an audible click. Two hours after the accident he came to me to be assured that the deformity was reduced or to have it corrected. Both externally and intranasally the parts were in perfect position. No retention apparatus was required, and the results are entirely satisfactory. The ease of maintaining the parts in position was inferentially brought out, in the discussion on fractures of the nose, by the American Laryngological Association at its meeting held in Washington in 1900. The paper was read by Dr. De Blois,[1] and in discussion it appeared that nearly every speaker had a method of retention differing from all others, yet all secured good results. This is one side of the subject, and is encouraging, especially since the majority of cases of deformity of the nose are due to displacement or fracture. If the general practitioner were impressed with the importance of giving early and sufficient attention to cases of injury to the nose, and understood that good results may be obtained by the exercise of a little ingenuity and patience, there would be fewer unsightly noses.

Treatment of Recent Fractures. Dr. Wright[2] has recently given a highly interesting review of ancient medicine, from which we learn that Hippocrates' knowledge of the treatment of fractures of the nose is well worth reviewing by the modern rhinologist. He insists upon the importance of thorough replacement of the fragments soon after the injury, and complains that many patients are unwilling to endure the pain necessary to a correct reposition. We have the advantage of general anæsthesia, and its use is to be recommended. I have been more inclined to advise this since a recent experience with a medical man who sustained a compound fracture of the nose. He demanded that ether be given, and the greater control of the situation which was thus secured was highly satisfactory, and no doubt contributed largely to the good result attained. The parts are restored to position by combined internal and external manipulation. The finger, a large probe, the handle of a cotton-carrier serves well, or a pair of Adams forceps with long blades may be used within the nose, aided by the fingers externally. When the fragments are replaced the parts are easily retained in position by means of an external appliance, or intranasal splints, or a combination of both. Sometimes after perfect reposition no retentive apparatus whatever is necessary. Indeed, Swain,[3] Clark,[4] and others treat most cases without any form of splints. This case of retention is due to the fact that the bones are not displaced by muscular action. The muscles attached to the nasal bones are too feeble to affect their displacement, a marked contrast to conditions prevailing in fractures of the extremities. Some modification of the Asch hollow vulcanite tube, as Meyer's or McKernon's, answers well, or Kyle's metal splint may be used. The rider splint devised by Leland is an ingenious and useful appliance. The accompanying cut (Fig. 538) represents an adaptation of this idea. A triangular-shaped piece of vulcanite, with the under surface grooved, and having an eye in the anterior extremity, through which is passed a silk thread, is placed in the upper part of the nasal fossæ, and McKernon's modification of the Asch tube is inserted beneath it. The rider splint is then drawn forward by means of the silk thread. As it is drawn forward the dorsum of the nose is elevated, and when this is brought into the right line the thread is tied across the front of the tube, in which grooves have been cut to receive it. This makes a firm support, allows of good drainage, and permits nasal respiration. If the rider splint is properly made, the appliance is worn with little discomfort and can readily be removed for cleansing. If an external splint is used Casselberry[1] recommends that it be made of plaster-of-Paris bandage, and he packs the fossæ with antiseptic gauze, using this as an internal splint. For external splint Shurley[2] advises gutta-percha. A sheet of proper dimensions is enclosed in a layer of gauze for padding, immersed in hot water until softened, and then moulded to the proper shape. This is held in place by strips of adhesive plaster. Roe[3] uses metal, tin, copper, or aluminum for the same purpose. He shows a neatly moulded splint of small size, held in place by adhesive plaster around the edges only. In bad cases it will be necessary for the patient to wear some part of the retentive appliance, either internal or external, for a period of from two to five or six weeks. The intranasal splint should not be removed under forty-eight hours, after which it is taken out at intervals, varying with the needs of each case, for sterilizing and to permit of cleansing the nasal passages.

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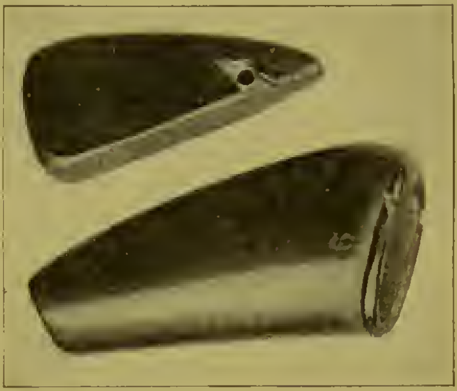
[1] Transactions of the American Laryngological Association, 1900, p. 12.

[2] Laryngoscope, 1901, vol. xi. p. 103.

[3] Transactions of the American Laryngological Association, 1900, p. 12.

[4] Ibid.

FIG. 538.



Rider splint above, vulcanite tube splint below.

This brief consideration of fractures of the nose is germane to the subject of treatment of deformity of the nose, since some of the principles of treatment are similar, but chiefly, perhaps, as a plea for greater care in cases of recent fracture—a prophylaxis against deformity. Prevention is better than cure. Deformities of the nose requiring plastic surgery for their correction belong rather to the general surgeon. Rhinologists are, however, treating every other deformity of this organ, and properly, as intranasal conditions as well as the external form require attention. Of classifications of these deformities, that of Roe is the best. This author has written extensively upon the subject, and has made all other workers his debtors, not only by his surgical achievements, but by his pertinent suggestions. His classification is as follows: "From a surgical point of view, nasal deformities may properly be divided into the deformities which affect the bony portion of the nose, and the deformities which affect the cartilaginous portion. Deformities of the bony portion may be subdivided into vertical, that is, those which distort the dorsal profile, in which the dorsal line is too convex or too concave; and lateral, that is, those which, when viewed from the front, present unusual deviation from the normal contour, whereby the bony portion may be either spatulated or deflected. Deformities of the cartilaginous portion may be subdivided into those which affect the tip of the nose, whether excessive or defective in the amount of tissue, or distorted from its normal direction, and those which affect the wings of the nose, which may be either collapsed or abnormally expanded."

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[1] Transactions of the American Laryngological Association, 1900, p. 12

[2] Diseases of Nose and Throat, 1900, p. 528.

[3] American Med. Quarterly, 1899, vol. i. p. 56.

Convex vertical deformity or exaggerated Roman nose is, with rare exceptions, congenital. Concave vertical deformity is a lowering or depression of the bridge of the nose. This is usually the result of violence from blows or falls, the deformity remaining as an evidence of improper or no treatment of a dislocation or fracture. It may be due to a lack of development of this part of the nose. It may also be due to loss of the supporting framework of the nose by disease. Syphilitic destruction is the most common cause of this loss of tissue. A depression of the cartilaginous portion sometimes follows abscess of the septum. The concave deformity may be exaggerated by excessive development of the end of the nose, or there may be apparent depression when the nasal bones and triangular cartilage are normal, in which case concavity is entirely due to abnormal development of the end of the nose. The broadened nose is usually associated with the concave deformity, the nasal bones bulging outward. This and the lateral deformity commonly result from neglected fracture. Collapse of the alæ of the nose may be due to failure in development. The alæ are sometimes especially narrow in subjects who have been mouth-breathers from infancy. They may also be held down by cicatricial contraction following injuries or specific ulceration. Expansion or spreading of the alæ is usually of congenital origin. A wide dilatation is sometimes caused by intranasal growths, as myxomata. I have seen one case where a considerable degree of this expansion seemed to be due to muscular effort. The nasal fossæ were narrowed by thickening and deformity following abscess of the septum. In the conscious or unconscious effort to secure more air the dilatores nasi become markedly developed, expanding the alæ. The resultant increase in the width of the nose exaggerated the deformity due to the abscess.

It should not be implied from the acceptance of this classification that every case of deformity falls clearly in one or another of the varieties named, or that a single operation will correct the entire deformity. Individual cases present all sorts of combinations, and each must be studied by itself. Some due to injury simply require a return to former position and contour, others require a reduction, as the exaggerated Roman nose; others still, as the saddle-back, must be filled in. Taking up, in order, the principal classes of deformity, convex vertical deformity has been treated by Roe with results that leave nothing to be desired. He operates subcutaneously, but his description of the technique is not sufficiently clear. Goodale[1] has devised and carried out the following ingenious method, well described in his report of a case: "The patient was etherized and placed in the Rose position. A pair of short curved scissors, with the convexity uppermost, was introduced into the left nasal vestibule. One blade was made to penetrate the triangular cartilage at its anterior extremity immediately beneath the integument, and a cut was made along the superior margin of both cartilaginous and bony septa, terminating at the junction of the perpendicular plate of the ethmoid with the cribriform plate. The superior margin of the septum was thus separated from the integument and from the nasal bones by this incision, the outline of which was essentially parallel with the angular outline of the bridge of the nose. The extremities of this angular incision were next connected by a straight cut made through the septum with straight scissors, and the portion of the septum included between the two incisions was removed with forceps. A septum with a straight superior outline was thus produced. The next step consisted in depressing the bony bridge of the nose so that it should rest upon the now straight septum. A small nasal saw was introduced with the teeth uppermost into the left nasal passage, and the articulation of the nasal and maxillary bones sawn through from below upward. A similar saw-cut was made through the corresponding articulation on the right side. The nasal bones were thus left articulating only with the frontal bone and with each other. A few comparatively gentle taps upon the nasal bones sufficed to break the frontal articulation and depress them, still firmly united with each other, until they came into contact with the upper margin of the septum. With the depression of the nasal bones the bridge of the nose assumed a straight line from tip to forehead, but a ridge at the same time appeared on either side, formed by the maxillary bone along the line of the nasal articulation. As determined by me previously, in experiments on the cadaver, two or three light blows with a protected mallet upon this ridge fractured the maxillary bone, which is here very thin, along a line situated about 1 cm. outside the nasal articulation and parallel to it, with the result of depressing the ridge and producing a perfectly smooth and even cutaneous surface. The operation occupied about forty minutes and was attended by comparatively slight hemorrhage. An external splint was applied to hold the nasal bones and the fragments of maxillary bone in proper position. The recovery from the operation was uneventful, being without headache or elevation of temperature. There was a slight nasal discharge for about ten days, which then ceased. The bones were firmly established in their new position in five weeks. Inspection four months after the operation showed a slight superior outline of the nose, smooth lateral walls, and a perfectly normal skin. The tip of the nose was not decurved, but the upper lip covered the incisors better than before the operation. Examination of the interior of the nose showed a straight septum, while the turbinates presented no discoverable change from their appearance previous to the operation. Nasal respiration and olfaction were normal. No abnormal subjective nasal symptoms were present.

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[1] Boston Medical and Surgical Journal, February 2, 1899.

"In recapitulation, the essential features of the preceding operation may be said to consist in the excision of the redundant portion of the septum, the separation of the nasal bones from their maxillary articulation, depression of the bony ridge to approximate the newly formed superior septal margin, and, finally, fracture and depression of the lateral maxillary ridges, the whole operation being performed intranasally and without wounding the skin."

Concave Vertical Deformity. Some cases of concave vertical deformity can be corrected to a presentable degree by refracturing the nasal bones, the cartilaginous and bony septum, and when the parts are sufficiently pliable, moulding them into position and holding them by retentive apparatus, as in a case reported by Harris.[1] Description of this method will follow. This saddle-back deformity has been corrected also by filling in the depressed portion with tissue taken from the septum, the patient sometimes conveniently carrying upon the septum a large spur which can be transplanted to the depressed dorsum. Roe and Goodale[2] have reported such cases with photographs showing excellent results. Under ether the spur is sawed from below upward; but the mucous membrane upon the upper side is left intact. With a knife introduced into the nostril, the skin is separated from the nasal bones and cartilages, thus forming a cavity to receive the spur, which is rolled upward, still adherent to the mucous membrane. The latter must be dissected up along the septum to allow of the excursion of the spur to its new position, but not separated from the septum, that the nutrition of the part may be maintained. The transplanted cartilage and bone may be retained in place by an external splint. Where it can be done, this would seem a wiser procedure than the introduction of a metal or celluloid splint, as has been done by Weir,[1] Monks,[2] and others. The transplanted tissue is said to become quite firmly fixed in its position. It certainly is far less likely to become displaced than a metal support, and it would be much more comfortably tolerated by the patient. This marks a distinct advance over the introduction of a foreign body.

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[1] Laryngoscope, March, 1899, vol. vi. p. 145.

[2] Annals of Otology, Laryngology, and Rhinology, November, 1900.

Depression of the nose over the triangular cartilage and due to contraction following septal abscess, but when no perforation has occurred, has been overcome by elevating a section of the cartilage. The dorsum of the nose is thus raised at the expense of a perforation of the septum. Goodale describes the operation in a reported case as follows: "The operation consisted essentially in cutting out a quadrangular piece of septal cartilage and lifting it upward subcutaneously until the external depression was filled out. Under cocaine and suprarenal extract an incision was made through the triangular cartilage about 1 cm. in front of its articulation with the perpendicular plate of the ethmoid and parallel to it, extending from the skin above to the vomer below. A second incision parallel to the first was then made through the cartilage, about 1 cm. behind the tip of the nose. The inferior extremities of the incisions were next connected by a third running parallel to the upper border of the vomer. A flap of cartilage was thus produced adherent only above to the mucous membrane and fascia corresponding to the external depression. On sliding the flap upward and forward in its own plane the skin of the depressed area was lifted up, and simultaneously a rectangular perforation of the septum was created at the lower border of the flap. The anterior and posterior ends of the flap were still in contact with the septum, although at a point higher up than that which they formerly touched. After being elevated to produce a nearly straight superior outline of the nose, the transported flap was held in position by gold-plated pins thrust through it and the adjacent septum on each side in an antero-posterior direction. The reaction was slight, and after three weeks the parts were sufficiently firm to permit removal of the pins. The bridge was firm and the patient had no discomfort from the perforation."

Neglected Fracture. In case of deformity due to neglected fracture there is usually no loss of substance, and the object in view is the return of the parts to normal position, and their retention until union has taken place. The indications are simple in spite of the apparently formidable problem sometimes presented by a bad deformity. The nose is remarkably tolerant of manipulation, and union after refracture will take place as readily as after the original accident. If antiseptic precautions be observed no severe reaction is to be anticipated. Under general anæsthesia the septum, if need be, and the nasal bones are to be refractured, and to such a degree that the nose is made pliable; it is then to be moulded into correct position, and by intranasal splints or a combination of intranasal and external splints so retained until firmly united in its new position. The Adams forceps with long blades is a suitable instrument for refracturing the septum. The same instrument with one blade covered with rubber tubing to protect the skin is used to grasp the nasal bones and refracture them, or, if necessary, a piece of steel covered with rubber tubing can be placed against the nasal bone or nasal process of the superior maxillary bone and struck a sharp blow to effect its fracture. As internal support the rider splint, already referred to, will do good service, elevating the depressed dorsum of the nose to its proper height, or the superior and middle meatus may be packed with antiseptic gauze and an Asch splint slipped in underneath to allow of nasal respiration. If this class of deformity is accompanied by depression over the triangular cartilage it will be necessary to make incisions through the cartilage, as described in Goodale's case, in order to secure permanent elevation of this section of the dorsum of the nose. If this is not done the section over the cartilage will return to its former level on removal of the internal splints.

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[1] Medical Record, January, 1895, p. 140.

[2] Boston Medical and Surgical Journal, 1898, vol. cxxxix. p. 262.

For the deformity of collapsed or widely-dilated alæ the cartilages are to be incised subcutaneously with a narrow knife sufficiently to render them pliable. In the after-treatment of collapse of alæ a tube is to be worn to give proper shape to the nostrils. This may well be of vulcanite. After widely-dilated alæ are rendered pliable an external form, as a plaster-of-Paris cast, is to be worn, supplemented, if need be, by an intranasal vulcanite tube, as recommended by Roe in such procedures.

Artificial Support. When the supporting framework of the nose has been destroyed, as in cases of syphilis, and the sinking in and contraction of the soft parts have given an ugly deformity, attempt has been made to supply the defect by introducing a metallic framework for support. If the loss of substance has not been great and the resulting deformity correspondingly less, a simple plate of metal slightly moulded or a suitably formed piece of celluloid has been made to sustain the skin along the dorsum of the nose, thus maintaining its contour. This metallic or celluloid form is best introduced subcutaneously or from within the nose, although instances are not wanting in which external longitudinal incision has been made,[1] the skin dissected up on either side, the plate placed in the cavity, and the wound in the skin closed above it. Good results are claimed for the last method, although my own observation would lead me to believe that these favorable reports must have been made soon after operation. If such support is to be used it is quite unnecessary to add an unsightly scar to a present deformity. The supporting material should be placed subcutaneously or by means of incisions within the nose. Among operators who have used this method celluloid has preference over any other material because it is well tolerated by the tissues. R. F. Weir was first to employ celluloid for this purpose. Platinum has been used in a number of cases; but it is easily displaced, and must then be removed; or it cuts its way through the end of the nose by mere force of gravity, and this in spite of the fact that numerous perforations have been made in the plate, with the expectation that the union of tissue through these openings would help to retain it in place. It is a fact, however, that even when this supporting substance has thus eluded the operator, the nose has been left in better form than before operation. Knight,[1] Weir, and Monks speak of this. The presence of the foreign body provokes inflammatory infiltration, and this increase of tissue remains to help fill in the former depression. Where the amount of depression is not great Goodwillie has succeeded in securing a considerable elevation by drawing heavy animal ligature under the skin and allowing it to remain. Done aseptically, little reaction follows. This he described in a paper which I think has not yet been published, read recently before the New York Academy of Medicine.

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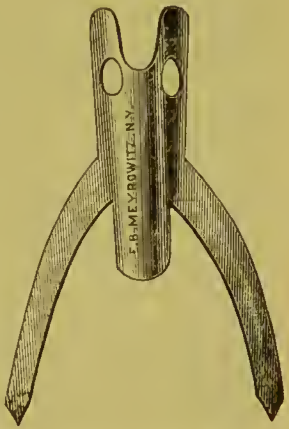
[1] Price Brown. Diseases of the Nose and Throat, 1900, p. 450.

The use of a metallic framework to support the nose after extensive loss of bone and cartilage was first suggested by M. Létiévant.[2] The artificial bridge was made of aluminum and his case reported in 1878. On his advice M. Claude Martin, who had done much in the way of correcting deformities about the face, made a bridge of platinum. This one in form and material promised firmer support than the earlier effort. Dr. R. F. Weir introduced the method into this country in 1892, and in January, 1896, had operated upon 10 cases. Dr. Knight, Nichols, and others have reported cases corrected by this form of support or some modification of it. I have had a limited experience with this class of cases. The first patient, a woman, thirty years of age, came under my care early in 1894. The deformity of her nose was due to extensive destruction of the cartilaginous and bony septum. There was not only saddle-back deformity, but the tip of the nose was elevated and the alæ much retracted. She was eager for any operation which promised to improve her appearance. The Martin bridge is expensive and its arms too narrow to sustain retracted alæ. I therefore devised the bridge shown in Fig. 539. It is cut from a single sheet of platinum, one-fiftieth of an inch thick, and then moulded to fit the individual case. The greater breadth

FIG. 539.



Platinum bridge.

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[1] Transactions of the American Laryngological Association, 1896, p. 150.

[2] La Prothèse immediate, Paris, 1899, p. 286.

of the body allows of it being moulded over the nasal bones, which prevents lateral displacement. The shape lessens the probability of erosion of the thin skin over the dorsum of the nose, and the broader arms support the alæ with less danger of destructive erosion. Perforations reduce weight somewhat and permit the union of tissue through the openings. The arms are left longer than will be required, and at the time of the operation are to be cut of suitable length. The ends of the arms are pointed and placed in holes drilled in the superior maxilla. The bridge is thus firmly fixed in position. It should be said that the supporting arms ought to stand more nearly at right angles to the body than is indicated in the cut, that the lower edges at the ends may not come so near the gingivo-labial fold. In the case referred to, Rougé's operation was performed and the bridge placed in position. In this operation the soft parts, including the external nose, are detached by an incision along the gingivo-labial fold and a dissection upward close to the bone, exposing the nares and separating the skin from the nasal bones. The bridge is then adjusted and the parts replaced. The proper moulding and adjustment of the metal support and the division of cicatricial tissue gives a complete restoration of external form. The deformity and *early* results are well shown in Figs. 540 and 541. If a metal support is to be employed Dr. Knight's dictum should be carefully observed: "(1) In syphilitic cases the patient must have had a thorough course of treatment, and a sufficient period must have elapsed since the disappearance of active symptoms—not less than three years; (2) the

FIG. 540.

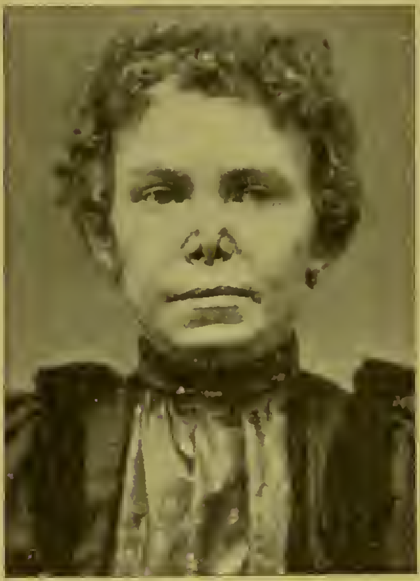

FIG. 541.

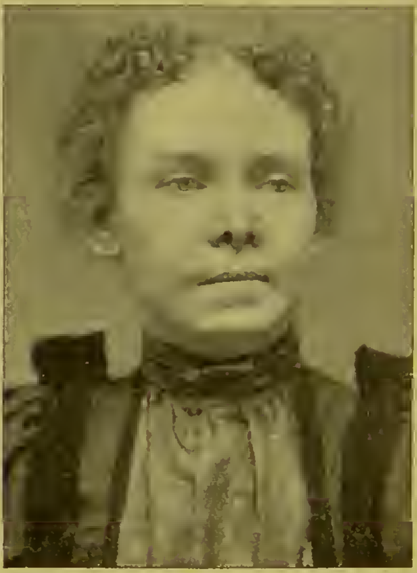

FIG. 540.—Concave vertical deformity, collapse, and contraction of alar cartilages, from specific disease.

FIG. 541.—Corrected by use of modified Martin bridge.

dissection of the soft parts must be so extensive as to obviate the possibility of tension at any point, and especially over the bridge of the nose, where the upper end of the plate is to rest. The metal bridge must be so moulded and smoothed down at its edges as to preclude the danger of friction and pressure upon the soft parts, and the ends of the supporting arms must be deeply buried in the maxilla, as otherwise they are liable to be dragged out of position."

A word as to this method of treatment may well be in order. The ultimate results of the use of the Martin bridge are often disappointing, notwithstanding the gratification at first experienced by both patient and surgeon. The operation necessary for placing the bridge is easily performed, and recovery is prompt. The objections are those arising from placing an unyielding foreign body within living tissues subjected to some degree of motion. In spite of all precautions some part of the form, either one of the supporting arms or the body over the nasal bones, will sooner or later cause erosion of the overlying skin. The structure itself has become bodily displaced. The interior may fill with granulation tissue, so that nasal respiration is cut off. Cicatricial tissue may cause unequal contraction, so that the soft parts are pulled to one side, sliding over the framework. Indeed, the final outcome of the bridged nose is such as to dampen the enthusiasm which arises over the immediate results of the operation. The wearing of an artificial nose of celluloid is to be commended, rather than the metal support with all its uncertainties.

CLEFT PALATE.

Cleft palate as here considered is due to a failure of development in early fœtal life. The perforations of the hard or soft palate which occur as a result of specific disease may sometimes be repaired by plastic operations; but this phase of the subject is not to be touched upon. Various theories are advanced to account for nature's failure to complete the work which she had begun. The interposition of the tongue of the embryo between the two approaching halves of the palate is one of the offered explanations.[1] Dr. Branth[2] in his interesting paper refers to the results of observations on lions in the zoological gardens of London. They were fed for a time upon flesh containing bones too large for mastication. The young born while this method of feeding was pursued had cleft palates. The lions were then fed upon smaller animals whose bones they could break easily, and the young born afterward had perfectly formed palates. This observation has been repeated at the "zoo" in Dublin and in Philadelphia. Some authorities claim that the want of a meat diet and a deficiency of the phosphates of lime in

[1] New York Medical Journal, 1901, vol. lxxiv. p. 241.

[2] Abs. Laryngoscope, 1899, vol. vi. p. 308.

the food of the mother act as a cause. The published statistics show that the English surgeons have performed many more operations for cleft palate than have Americans. May the factor of a more generous diet among the poorer people here partly account for this? Heredity has been assigned as a cause by some authors. The cause, whatever it be, is a matter of small moment to the practical surgeon. "It is a condition, not a theory," which confronts him. The cleft between the two halves of the palate varies from the slightest degree, as the bifid uvula, to a complete cleft of the soft palate, and even of the hard palate forward to and through the alveolar process. This cleft is in the median line until the incisive or intermaxillary bone is reached. This small portion containing the incisor teeth is, in young bones, marked off from the maxilla on each side by distinct suture lines. If the deformity under consideration extends through the alveolar process the cleft deviates from the median line on reaching the maxillary bone; and if the cleft be double, as it sometimes is anteriorly, this bone is entirely separated from the maxilla and hangs from the end of the septum. The operation for closure of cleft palate has been done for a century, and, as might be expected in a problem of such difficulty, has engaged the attention of the ablest surgeons. The accumulated experience during this long period of numbers of workers has resulted in an improvement in technique which gives the operator of to-day a great advantage, and yet unsuccessful efforts are not infrequent, so trying are the conditions presented by this deformity.

The changes contributing most notably to a successful issue were, first, Fergusson's division of the palatal muscles to reduce the tension upon the sutures, and, second, the introduction of general anæsthesia. One is possessed with profound admiration for the skill and patience of the surgeon of early days who, without anæsthesia, either local or general, and without the aid of sterilization or antiseptics, yet undertook this difficult operation and carried it through to a successful end. The Smith mouth-gag was the third improvement in point of time, and Warren's filling of the fissure in the hard palate by means of the mucoperiosteal flap the fourth of the major improvements. In spite of every aid gained from the accumulated experience the operation is often a partial or total failure, either from undue tension direct upon the sutures, or from functional activity; or failure is due to bacterial invasion or lack of recuperative powers on the part of the patient.

The history of staphylorrhaphy is interesting for several reasons, and in none more than in the change which has taken place in the opinion regarding the proper age at which the operation should be performed. The older writers, lacking the advantage of anæsthesia, and looking rather to good surgical results than perfect function, advised a late operation. It was necessary at that period to rely in some instances upon the assistance which the patient could voluntarily render, even if it were not other than the passive aid of not offering resistance. One early author[1] states: "As the success of the operation depends in a great measure upon the patient remaining perfectly tranquil and steady during the necessary procedures, which are of a tedious and protracted character, upon his assisting the surgeon by opening his mouth and not struggling on the introduction of the instruments, and after the operation upon his making as little movement as possible in speech or deglutition for some days, it is usually considered expedient not to interfere with this malformation until the patient has attained the age to understand the necessity of remaining quiet and to be able to control his movements."

The operation is a difficult one, and when one thinks of the problem presented of freshening the edges of the cleft and inserting sutures in the small mouth of a struggling child, at an age in which the tissues are easily lacerated, he is ready to approve for the earlier surgeons of the plan of operating when it can be done at the patient's request and with his assistance. The use of anæsthesia has changed this, and the reasons for operating early are unquestionable, first, because of the more perfect establishment of the function of the palate. At an early age this assures the nutrition of the child. In complete cleft of hard and soft palate swallowing is a matter of such difficulty that the child requires the almost constant attention of a nurse. Consideration of the parent, too, should have some weight. To many a woman the deformity of the child can but arouse a feeling of horror. Next to the functional aid in nutrition is that of phonation. All authorities are agreed that in voice production the early operation offers vastly better prospects of good results. Makuen[2] says both the tongue and the palate are important in the function of speech, but the palate is the more so. The purely vocal elements of speech, such as the vowel sounds, may be articulated when the palate is defective, but their resonance is so impaired that they are scarcely recognizable. Of the consonant sounds, only two, *m* and *n*, can be articulated intelligibly when the palate is not intact, because in the pronunciation of the other consonants the palate is necessary to prevent the passage of air upward. Perforation of the palate affects speech to a greater or less degree, depending upon its position. Surgical measures for the relief of cleft palate should be undertaken as early as possible in the formative speech period, and these should be supplemented by instruction and practice in the normal production of speech.

By no means least among the reasons for early operation is the influence upon regional development. Formerly it was considered debatable whether the fissure in the hard and soft palate, when both existed, should be closed at the same operation, and it has been asserted that if the cleft in the soft palate were closed early in infancy the fissure in the hard palate would gradually become narrower until, in some instances, this would not require operation. If this were true, even to a slight degree, how much more nearly normal would development be when the entire cleft were closed at an early period. Development within the nose and nasopharynx would also be more nearly normal. In cleft palate of the adult the inferior turbinated bones are sometimes so greatly hypertrophied as to extend into the cleft, and removal is necessary before operation for closure of the cleft can be undertaken. Adenoids are also quite likely to develop, and the mucous membrane of the nose and nasopharynx to be in a highly inflamed condition. The Eustachian tube and middle ear become involved, with the consequent unhappy train of disturbances of the functions of the ear. All these reasons call for early operation. R. W. Murray[1] says from his experience in 195 operations for harelip and cleft palate, he is convinced that the operation for harelip should be performed about the fourth week, and that for cleft palate about the twelfth month, that is, before the child has begun to talk.

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[1] Erichsen. Science and Art of Surgery, 1873, vol. ii. p. 459.

[2] New York Medical Record, 1901, vol. lx. p. 78.

Goodwillie[2] has operated as early as the twelfth hour after birth. Abbe says the earlier one operates the better, and he has secured good results in one case two days after birth. The soft parts once in proper relation tend to mould the hard parts, and, as in case of harelip, the operation ought to be done early. B. F. Curtis also advises operation in infancy. Dr. Broca[3] does not hesitate to operate upon a child from three to six months old, provided it can have proper care.

Since the operation is not one of immediate urgency, sufficient time may be taken to secure the best possible degree of general health, and this is especially important if the patient is a young child. At a later period a number of local points will require attention in an effort to reduce to a minimum the obstacles to success. Carious teeth should be filled or drawn, and an antiseptic mouth-wash used carefully for a period before operation. Adenoids should be removed, as also should the faucial tonsils, and at a date early enough to allow of perfect healing, before the operation upon the palate is undertaken. The reasons for this are too obvious to require stating. In some cases the inferior turbinated bones are hypertrophied to such a degree that they project into the cleft. These should be removed under the rules just named. Every effort should thus be made to bring the patient up to a good state of health, and locally to reduce so far as possible the dangers of infection, and to remove sources of pressure, of irritation, and of interference with respiration. The technique of the operation for closing the cleft is quite well agreed upon, and this will be given before mentioning any modification. If the case be one involving the hard palate, or if the patient is a child, or not easily managed, general anæsthesia should be employed.

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[1] British Medical Journal, October 15, 1898.

[2] New York Medical Record, 1896, vol. xlix. p. 460.

[3] Ibid., vol. l. p. 68.

The Rose position—the head hanging over the end of the table—is the preferable position. This is commended for the reason that the blood and mucus are thus less likely to enter the larynx. The usual sterilization of hands, instruments, and field of operation is of course to be observed. The Smith mouth-gag is introduced, which is self-retaining, opens the patient's mouth to the widest extent, and at the same time depresses the tongue. The mouth, teeth, buccal cavity, the nose, nasopharynx, and pharynx are to be carefully sterilized. The edges of the cleft are to be freshened from the tip of the rudimentary uvula to the apex of the cleft, from behind forward. The tip of the rudimentary uvula is seized with a long pair of volsella forceps, and the edge freshened with a knife or scissors curved on the flat. Recent writers prefer the latter, stating that a broader surface is secured, since the cut may be a bevelled one. Care should be taken to preserve as much as possible of the rudimentary uvula, since it will contribute to the more perfect function of the palate. Bleeding may be controlled by pressure or by gauze sponges wrung from a hot normal salt solution. It is quite possible that the use of adrenalin would control hemorrhage to some degree, and might well be tried. If the cleft is in the soft palate alone the sutures are now to be placed. If the hard palate be involved the next step will be the elevation of mucoperiosteal flaps. Incision upon each side is made parallel with and near the alveolar border, and of a length equal to that of the cleft in the hard palate. This incision extends through to the bone. With periosteal elevator this mucoperiosteal flap is raised, care being taken not to wound the palatine arteries in the process of separation from the underlying bone. As thus separated, this flap is attached only anteriorly and posteriorly and slides perfectly freely over the bone from which it was detached. The free bleeding is to be controlled by pressure or the use of sponges wrung from a hot solution. Many devices have been proposed for introducing the sutures, which is the most difficult part of the operation. The needle in a long handle, with a half-round curve at right angles to the shaft of the instrument, gives good satisfaction. Some operators use an ordinary small half-round curved needle.

It is interesting to observe how similar conditions lead different workers entirely independent of each other to adopt like methods. A friend—a general surgeon of wide experience—mentioned to me in discussion of this subject that he found it convenient to pass the sutures with a small half-round curved needle, inserting it from behind forward. For example, the suture would be inserted from behind forward upon the left side, and the needle drawn through. The end of the suture would now be threaded into another needle and passed from behind forward upon the right side. Aided by forceps and a small needle holder, this was said to be quite easily done. This seemed an ingenious manœuvre, and was original with this surgeon, yet I found the same suggestion in a copy of an old work on surgery which was consulted for historical points. The method which permits of passing the sutures from before backward has in its favor the possibility of placing them with better symmetry and exactness, since the point of the needle enters the mucous membrane of the roof of the mouth where it can be plainly seen. This plan may be carried out as follows: a suture is passed through one side from before backward. A needle with an eye near the point, the one in the handle, already spoken of, is passed through the opposite side. The loop which it carries is held by forceps while the needle is withdrawn, and the suture first placed is passed through the loop which, on being withdrawn, carries the suture with it. Beginning in front, the sutures are placed about one-third of an inch apart. The suture material may be of silk, silkworm-gut, or silver wire. Silk cannot be allowed to remain as long as the other, yet, if union has not taken place within six or seven days, it is not likely to occur. To relieve the tension on the sutures incision is now made through the soft palate, as first recommended by Fergusson, internal to the hamular process upon either side. This divides wholly or in part the fibres of the levator palati, tensor palati, and palato-pharyngeus. Tension may still further be relieved by snipping the anterior and posterior pillars with scissors. After operation effort is made to keep the parts cleansed with an antiseptic mouth-wash or spray, boric acid serving well. Semisolid food, as beef jelly,. custards, etc., are advisable rather than fluids, since these are more easily swallowed. So far as possible, the patient should avoid functional use of the palate, since any movement is prejudicial to union. Accidents will occur in spite of all precautions. Violent sneezing has been known to separate parts which up to that event promised well in the way of firm union. Staphylococcic infection may occur, with a consequent failure of union in at least a part of the wound. Should this happen, Owen[1] advises that a secondary operation should be performed within a short time, and mentions a case in which, after two weeks, the granulating edges were freshened and brought together by sutures placed wide of the cleft. As good results were secured as could have followed complete primary union. Owen urges this prompt effort to overcome the effects of septic infection, on the theory that the patient has acquired an immunity by his attack, consequently there is the better prospect of securing immediate union. The sutures should be allowed to remain eight or ten days, and then not removed all at one time, but here and there, as seems best.

McKernon[2] has proposed as a preliminary to the operation of closing cleft palate that tracheotomy be performed, the anæsthetic being administered through the tube; and after the operation that the wound be packed, as in any other operation, the patient being nourished by the rectum. The following is a description of the operation as performed by him in so far as it varies from the usual technique:

[1] Journal Laryn., Rhin., and Otol., 1898, p. 462.

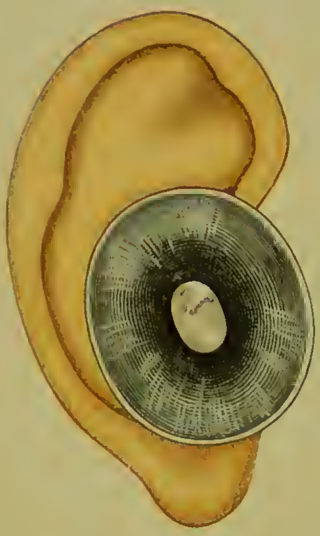
[2] New York Medical Journal, June 16, 1900.

A large, flat, thick piece of plain sterilized gauze, with a string attached, is placed in the lower part of the pharynx, covering the entrance of the larynx and œsophagus, thus shutting off all possibility of foreign substances, such as blood, solutions, etc., from being carried into the larynx or the œsophagus. The string passed through this piece of gauze is allowed to hang out of the mouth, with a clamp attached to it, so that, if necessary, it can be quickly removed. There should be several of these pieces of gauze on hand in case the one in position should need to be removed, as sometimes occurs when it becomes saturated with blood. The operation is then done in the usual way, and, after the oral cavity has been cleansed again by the normal salt solution and the pad removed and replaced by a fresh one, a thin strip of sterilized gauze, about an inch and a half wide, is passed between the under surface of the repaired palate and posterior pharyngeal wall. Plain sterilized gauze is then used to pack the lateral incisions, and here the packing should be quite firm. Sterilized gauze is also used over the whole of the operative field, the cavity of the mouth is filled completely to the front teeth, and the gauze is then pressed rather firmly against the under surface of the new palate. Should vomiting occur and soil the dressings while the patient is recovering from the anæsthetic, then we must redress. This happened twice in one of his reported cases, and not at all in the others. If no vomiting has taken place the packing should be removed at the end of forty-eight hours, and the parts gently sponged with either a hot saline solution or a weak solution of formalin, and the wound gently repacked. Owing to the salivary secretions, which are now increased by the mechanical irritation of the dressing, the packing should be removed each day and the parts cleansed as before. The tracheotomy tube is left in for about twelve days, during which time the patient is nourished by the rectum.

Dr. McKernon very kindly stated to me that he has now employed this method in 14 cases, with primary union in every case but one, and in this the failure to unite was for only a small portion of the wound, which was readily refreshened, and the ultimate results were perfect. The doctor deserves great credit for the originality and boldness with which he has carried out a plan which seems from the purely surgical side much more certain and correct in its technique. The method would hardly be recommended in very young children, for example, at the age suggested for operation by Goodwillie, Abbe, Curtis, and others. In selected cases among older children and adults, however, a method which tends to assure primary union by keeping the parts more nearly sterile and at rest has much to commend it.

THE EAR.

PLATE XXVIII.



Membrana Tympani as Seen Through a Speculum.

THE EAR.

CHAPTER XXV.

EXAMINATION OF THE EAR; DISEASES OF THE EXTERNAL EAR; DISEASES OF THE EXTERNAL AUDITORY MEATUS; OTOMYCOSIS; FOREIGN BODIES; WOUNDS OF THE MEMBRANA TYMPANI.

By F. E. HOPKINS, M.D.

EXAMINATION OF THE EAR.

The necessary instruments for making an examination of the ear are a light, a concave mirror, and a speculum. To secure satisfactory results with these implements, however, some familiarity with their use is essential, together with a knowledge of the anatomy of the ear.

Fig. 542.

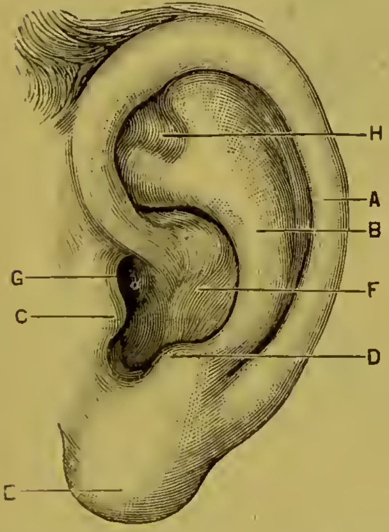


Fig. 543.

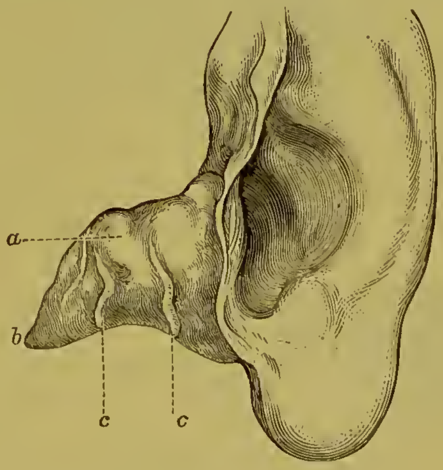
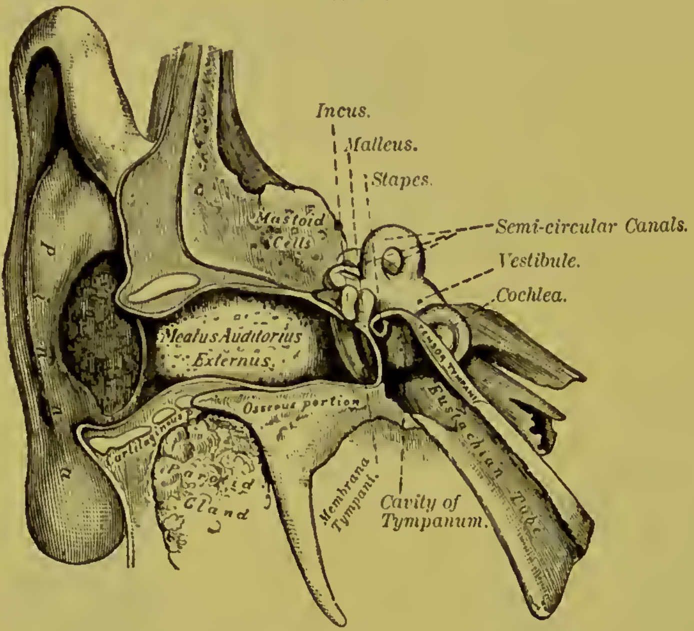


Fig. 542.—Auricle. A. Helix. B. Antihelix. C. Tragus. D. Antitragus E. Lobule. F. Concha. G. Orifice of the external meatus. (Politzer.)

Fig. 543.—The auricle and the cartilaginous part of the external auditory canal. (Left side.) *a.* Cartilaginous meatus. *b.* Inner pointed end which unites with osseous part of the auditory canal. *c.* Fissures of Santorini. (Politzer.)

The light and its fixtures may be simple or elaborate, as the taste or the purse of the owner may dictate; direct sunlight may be used when available, or one may make use of a candle. In an office the light is quite likely to be an Argand gas-burner, and if one plans to do nose and throat work, he will be provided with a Mackenzie condenser (Fig. 545), which he will also use in ear work, although good authorities assert that no condensing lens is necessary for examining the ear. In a private house satisfactory illumination may be had from a kerosene lamp. In case the external meatus is abnormally wide and straight, it is sometimes possible to examine the ear by direct sunlight. The direct light of an electric lamp suitably mounted for wearing upon the forehead may be substituted for the reflected light of the forehead mirror. The electric light serves a useful purpose in ether operations, since the risk of igniting the ether is thus avoided. For general work sunlight cannot be depended upon, and batteries are uncertain. The forehead mirror has quite superseded the hand mirror for reflecting light into the ear, for the very good reason that illumination is thus quite as good, and both hands are left free for manipulation of instruments. Good head mirrors are now so readily purchasable that no further description is necessary than that the head-band should be of inelastic ribbon, that the focal distance should be about seven or eight inches, and that the mirror be worn over the eye, enabling one to look through the perforation in the centre, thus allowing inspection in the focal line and giving the maximum degree of illumination. When the mirror is worn in this manner the eye is protected from the direct rays of the

FIG. 544.

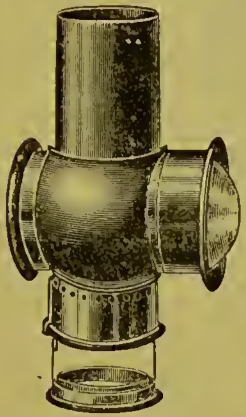


A front view of the organ of hearing (right side). (GRAY.)

light. For continuous work before a condensing lens this protection is a matter of considerable importance.

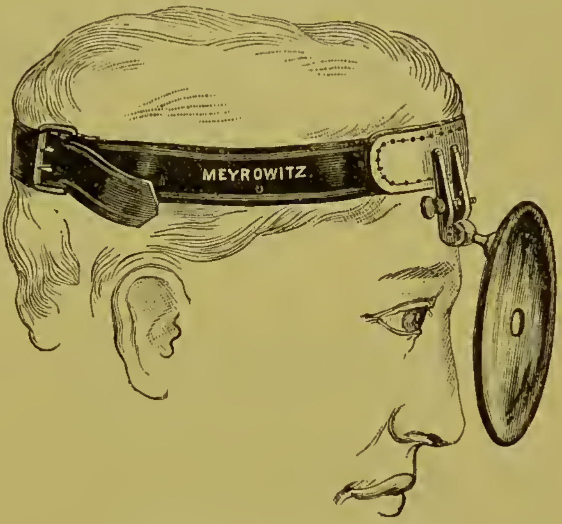
There is a large variety of ear specula from which to make choice. McBride facetiously remarks that many aurists have devoted their leisure to inventing specula that they might attach their names to them. Satisfactory work can be done with any one of them if in the hands of its master. It is only necessary to speak of the essential conditions to which all should conform. A speculum should not be too long, as this interferes with the manipulation of instruments through it. The length should not exceed one and three-eighths inches. One should have at least three different sizes. The smallest end of the smallest size should not be less than one-eighth of an inch in diameter, and not more than five-sixteenths of an inch for the smaller end of the largest size. The speculum should be of bright, polished metal, silver or nickel, to aid in reflecting light, and the walls of the instrument should be as thin as possible, to increase to the utmost the space available for illumination. For this same reason the Gruber speculum (Fig. 547) is to be recommended, as its oval form in cross-section corresponds to the anatomical shape of the entrance to the external meatus, thus admitting of the greatest possible illumination.

FIG. 545.



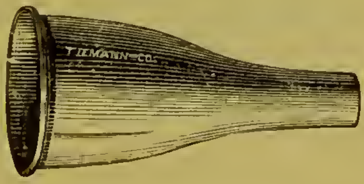
Mackenzie's bull's-eye lens and reflector.

FIG. 546.



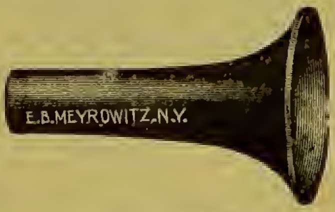
Indirect illumination of the ear.

FIG. 547.



Gruber's speculum.

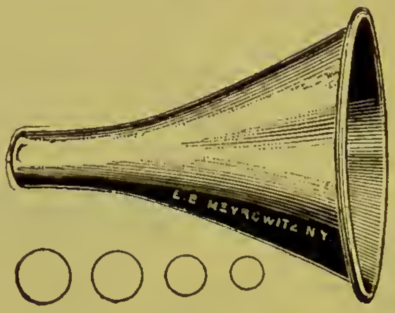
FIG. 548.


E.B.MEYROWITZ.N.Y.

Politzer's speculum.

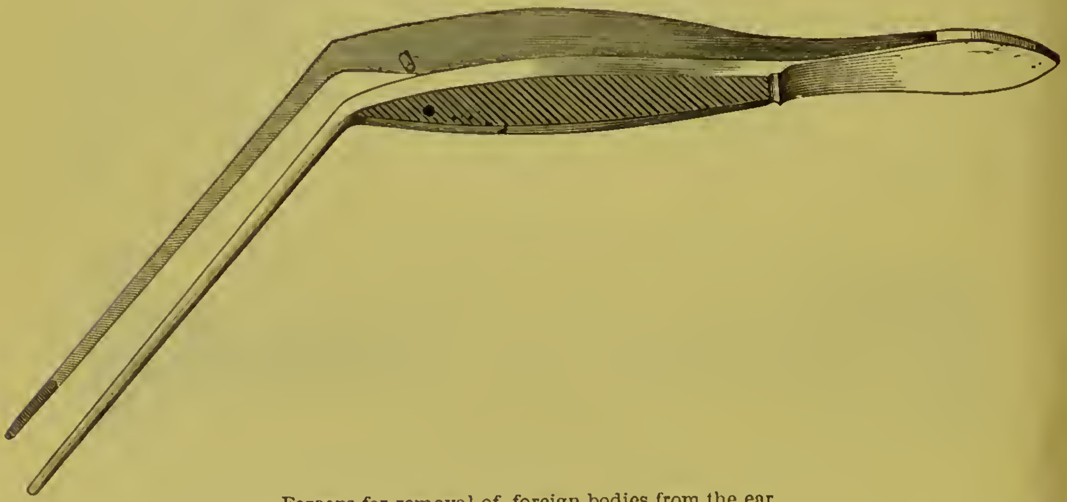
The position of the patient with reference to the light is a matter of some importance, since it is desirable to secure opportunity to manipulate instruments without interfering unduly with illumination of the field. This is best accomplished by placing the light at the examiner's left and somewhat above the level of the ear to be examined. The light must not be too far from the observer, since this diminishes illumination. The patient should sit so that the ear to be examined is on a level with the examiner's eye. The light is directed into the patient's ear by tilting the mirror. This adjustment of the reflecting mirror is made by the hand, without any movement of the observer's head, which is thus allowed to assume the most comfortable position for examination. The speculum, after being warmed, is introduced into the entrance of the auditory canal by a slight rotary movement, and held in position by the thumb and index finger of the left hand, while at the same time the ear is lifted upward and backward, to straighten the canal, by the index and middle fingers of the same hand. The speculum must be held so that the axis of its long diameter is parallel with the axis of the canal. To secure the best illumination,

FIG. 549.



Boucheron's speculum.

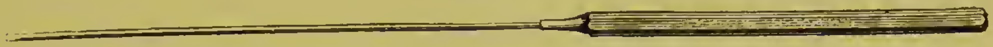
FIG. 550.



Forceps for removal of foreign bodies from the ear.

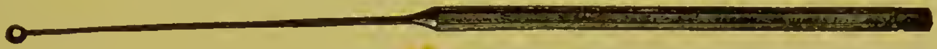
the largest speculum which the canal will admit should be used, but no speculum should be forcibly inserted into the ear. Indeed, all manipulations about the ear must be free from anything like roughness or heavy-handed movements. In case of tenderness about the ear, examination at first may well be made by gentle traction on the auricle under a good light. It is quite common to find the meatus obstructed by exfoliated epithelium, cerumen, purulent discharge, by hairs, or by other foreign bodies. The external auditory canal must be perfectly clean in order to permit of that thorough inspection which alone can lead to accurate diagnosis. The instruments used for this purpose are the blunt curette, the slender cotton-carrier, a pair of light angular forceps, and the syringe. The blunt curette is used much more frequently than the forceps, while the cotton-carrier, armed with a small pledget of tightly-wound cotton, is more constantly in the hands of the otologist than any other instrument. The syringe is used for the removal of soft cerumen, foreign bodies, and for the removal of pus when it is present in considerable quantity or is of a stringy, tenacious character. Following the use of the syringe the canal should be thoroughly dried with cotton. Examination of the ear should be by touch as well as by sight. The impression gained by palpating an inflamed or thickened auricle is of great aid in making a diagnosis, and an interpretation of the significance of tenderness and swelling about the auricle and over the mastoid can only be made out by palpation.

FIG. 551.



Cotton-holder.

FIG. 552.



Buck's blunt curette.

FIG. 553.

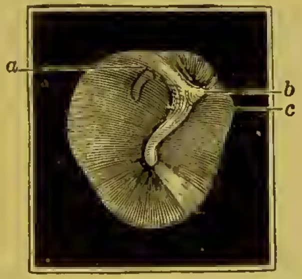


FIG. 554.

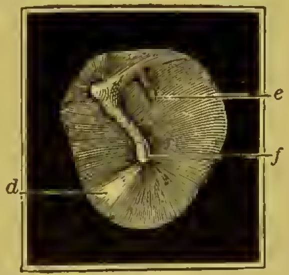


FIG. 553.—Normal drumhead (right ear). *a.* Posterior fold. *b.* Short process. *c.* Anterior fold. (POLITZER.)

FIG. 554.—Normal drumhead (left ear). *d.* Cone of light. *e.* Long handle of incus. *f.* Umbo. (POLITZER.)

DISEASES OF THE EXTERNAL EAR.

Some of the affections of the auricle are such as are common to the skin of any part of the body, and require the same treatment. Among these are dermatitis, due to injury, stings of insects, burns, and frostbite. Such as these, whether slight or severe, and whether simple or infected by bacteria, causing erysipelas or any septic process, are to be treated on the principles laid down in text-books on dermatology.

Eczema is one of the most common diseases of the external ear and meatus. It is frequently seen among the children of the poor as a result of uncleanliness and bad nutrition. It is more common with children than adults in any social scale, being with them one of the expressions of a strumous diathesis. In the chronic scaly form it exists to the torment of many adults who dig at the meatus with pins, toothpicks, tip of a penholder, or anything within reach in the effort to gain relief from the itching. Serious injury is thus sometimes done to the meatus or membrana tympani, or, if these parts are not directly lacerated by the instrument used, the irritation resulting from the repeated traumatism ends in inflammatory infiltration and thickening of the lining of the meatus and an aggravation of the original trouble. Eczema of the ear occurs either as an acute or a chronic disease. The bony portion of the canal is not likely to be involved, the drum membrane also is rarely affected. The disease is usually located in the cartilaginous portion of the meatus or upon some part of the auricle, or both meatus and auricle are involved. If the auricle alone is affected it is likely to be at some point where the skin is folded upon itself, as in the fossa helicis, and in the angle behind the ear, where the skin is reflected from the ear upon the mastoid process. Acute eczema begins with redness and swelling of the skin, which is soon followed by the appearance of vesicles filled with serum. These break, and the exuded fluid in the canal is sometimes mistaken for discharge from the middle ear. The bursting of the vesicles leaves a moist surface. This after a few days becomes covered with yellow crusts, and exudation occurs underneath.

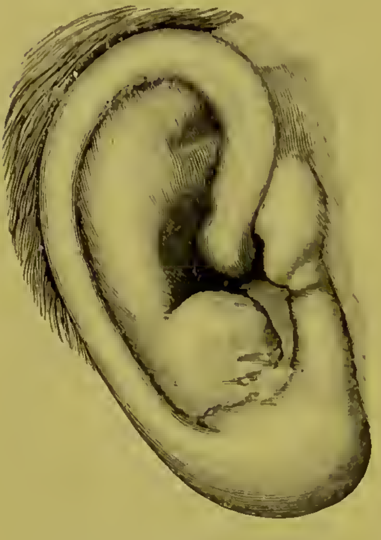
Etiology. Acute eczema may occur in this locality primarily or in connection with the disease in other parts; but the cause, unless it be an external irritation, is not easily assigned. Of external irritations the most common are applications to the ear or meatus. In some patients with a sensitive skin the efforts toward cleanliness, by the frequent use of soap and water, is sufficient to excite an eczema. An acute or chronic discharge from the middle ear is often sufficiently acrid to cause the disease.

Symptoms of acute eczema are a burning pain and an intolerable itching in the affected part, with redness, swelling, and the formation of vesicles. The function of hearing is not impaired, unless the meatus becomes occluded from the swelling and the accumulation of crusts and desquamated epithelium. In acute eczema not dependent upon a persistent cause, as an otorrhœa, a new epidermis forms beneath the crust of exudation, and, after the latter has been removed, soon assumes a natural appearance. Frequently the disease continues for some weeks, and if the external irritant be kept up or the patient's health is reduced from any cause, frequent relapses occur and the disease passes into the chronic form. In chronic eczema there are deeper tissue changes in the skin. There is thickening of the subcutaneous connective tissue in the more severe forms, and this narrows the meatus. The auricle is enlarged and hardened. In bad cases there is a crust formation, underneath which a serous or purulent fluid is exuded. The more common chronic form is characterized by the formation of fine scales. There is some hyperæmia and thickening of the skin and a constant desquamation of scales. This is very frequent as an affection of the cartilaginous portion of the meatus. With this sometimes occur fissures at the entrance to the meatus. These fissures are moistened by a slight exudation. The severer forms of eczema are obstinate, not yielding readily to treatment, and frequently relapsing.

Diagnosis. The characteristic feature of this disease is an exudation and crusting. The stage of exudation may have passed before the patient comes under observation; but the history will reveal a period of discharge, and removal of crusts will show a moist surface underneath. The chronic squamous form may not easily be differentiated from pityriasis simplex; but this is a matter of no great importance so far as treatment is concerned.

Treatment. This is almost wholly local, yet certain general conditions, especially with children, should receive attention. Care of the general health, the regulation of diet, limiting this to simple easily-digested food, and at regular intervals, the use of cod-liver oil, syrup of the iodide of iron, and Fowler's solution will be helpful. Adults may require similar care, especially with regard to digestion, renal or cardiac disease, gouty tendencies, etc. The first care in local treatment is to remove all sources of irritation. If this is the too free use of soap and water, suspension of this and the application of an oleaginous preparation will quickly bring relief. The irritation may be due to an acrid discharge from the middle ear, and if this can be overcome the eczema will often require but little treatment for its cure. In a general way it may be said that for acute eczema soothing applications should be used, while in the chronic form stimulation is required. In the early course of acute eczema, in the period of heat, redness, and swelling, a solution of subacetate of lead will relieve the pain. A little later Hebra's diachylon ointment is a most satisfactory application. The officinal benzoated zinc ointment is also much used. The treatment of chronic eczema will require much patience. There will be periods of improvement and relapse. On the occurrence of exacerbations, with redness and added irritation, the astringent ointments, as those of lead and zinc, should be used. The diachylon ointment is made more easily applicable by dilution with olive oil or "cold cream." As prepared it is rather hard and stiff. When no progress is being made, when pain and other indications of acute exacerbations have long been absent, then stimulation must be employed. For this purpose strong solutions of nitrate of silver have long been used. In some cases of an obstinate character, in which the ear is thickened and distorted by the chronic process, applications of acetum cantharidis will set up a renewed activity, ending in improvement. The usefulness of oleaginous preparations depends, no doubt, in good part upon their quality of protecting the surface from the air and from water. The injurious influence of the latter in this disease is understood even by the laity. In order to secure good results from any application the crusts must be removed; this is to be done in a manner as little irritating as possible. The crusts should be softened by the use of olive oil or vaseline, after which they can be quite readily separated. The objection to the use of ointment in the auditory canal, because of the risk of obstruction from the accumulation, can be obviated by instructing the patient to wipe out the canal each time before making a new application.

FIG. 555.



Thickening and deformity of the auricle due to chronic eczema. (BACON.)

Herpes zoster occasionally affects the ear, but it usually occurs only in connection with manifestations of the disease in other localities. It is attended by severe pain of a neuralgic character and the formation of vesicles along the distribution of nerve branches. Pain may be so severe as to call for the hypodermic use of morphine. After rupture of the vesicles, application of some simple ointment, as that of zinc oxide, is to be made.

Lupus also is rarely seen, except as accompanying the same disease of the face, and even in this connection it occurs in but 5 per cent. of the cases.[1] Lupus vulgaris and lupus exulcerans are best treated by the galvanocautery. In the latter form the spongy granulations are first removed with a sharp spoon, after which the galvanocautery is thoroughly applied. This vigorous treatment ought to be used early to prevent, so far as possible, the deformity resulting from loss of tissue and cicatricial contraction. These cases are proper subjects for treatment by the x-ray.

Primary syphilitic affection of the auricle is to be mentioned only as a curiosity. Politzer refers to but four such cases. Secondary eruptions may occur along with the general symptoms, taking on the squamous, pustular, or papular form, whichever the cutaneous manifestation happens to be.

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[1] Journal of Laryngology, Rhinology, and Otology, 1900, vol. xv. p. 451.

Another of the rare affections of the ear is *cornu humanum*, a horny growth springing from the outer border of the helix. One such case has come under my observation. It occurred in a man about sixty-three years of age, and was situated on the upper border of the helix. The growth stood nearly upright, although curved a little backward. It was of a dark color, of horn-like hardness, and distinctly striated. Its length was one-half of an inch, and the greatest diameter at the base one-half of an inch. The base was exquisitely sensitive, as a result of the mechanical irritation from accidental movement of the growth in brushing the hair, etc. He laughingly told me that he had suffered much from the well-meant officiousness of friends, who, observing the growth in the twilight, mistook it for a bug or a fly, and with a quick movement, intended to dislodge or capture the bug, gave the ear a blow which caused much pain, because of the sensitive base of the neoplasm. The growth was removed under cocaine anæsthesia, an elliptical cut being made through the skin, the base dissected out, and the cut edges of the skin brought together by a few fine sutures. Healing was by first intention, and after four years there is no return of the growth.

Of benign tumors of the auricle, fibroma is most common, and sebaceous cyst, perhaps, comes next in frequency. Lipoma and angioma are said to be exceedingly rare.

Malignant disease of the ear may be primary or secondary to its appearance upon the face or neck. According to Connal,[1] who examined the statistics of the Glasgow Ear Hospital, in 15,000 cases malignant disease was recorded six times, four epithelioma and two sarcoma. Epithelioma appears to be less rare than sarcoma, and the former more frequently attacks the auricle, while sarcoma is oftener found in the canal than in the external ear. Connal's case was a spindle-celled sarcoma of the canal. The child, a girl of six years, died of recurrence after seven months. I have seen one similar case in a boy three years of age. The growth filled the external auditory canal. From its color, consistence, and the attending discharge, it was assumed to be a polyp. It was removed under ether, and fortunately submitted for microscopic examination, which proved it to be a round-celled sarcoma. Rapid recurrence, with extensive involvement of the surrounding structures, took place and the child died about six months later. In case of malignant disease of the auricle operative treatment should be resorted to as soon as diagnosis is made, and the entire auricle sacrificed if necessary. Successful result has been reported, even when the parotid and cervical glands had to be removed because of involvement.[2]

The occurrence of marked and persistent pain in connection with new growths in the canal should excite suspicion of malignancy and lead to microscopic examination. These cases often come under observation too late to permit of operation with any hope of successful issue. The toxins of erysipelas, as advocated by Coley, might be tried in so desperate a situation.

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[1] Journal of Laryngology, Rhinology, and Otology, November, 1899, p. 606.

[2] Burnett. Ear, Nose, Throat, 1893, vol. i. p. 164.

Wounds and Injuries of the Auricle. It is an anomaly that wounds and injuries of the external ear, exposed as it is, should be so much rarer than injuries to the membrana tympani hidden away within a bony cavity. Statistics show that a serious injury to the external ear is a rare accident, while a wound of the drum membrane is a relatively common occurrence. Perhaps the most frequently seen deformity of the auricle due to injury is the slit of the lobule from the tearing out of an ear-ring. Even this occurs less frequently than formerly, with the passing of the vogue for wearing ear-rings. When this deformity exists the individual rarely cares to go to the trouble of having the tear closed, although a trifling plastic operation would overcome the defect. Injuries from blows or falls sometimes cause marked deformity due to loss of substance, either from direct laceration of the tissue or from the subsequent inflammation and necrosis. The author has seen a case of the loss of the upper half of the auricle as a result of a fall from the old style "ordinary" bicycle to the frozen ground. If an incised wound of the auricle is seen soon after the injury the edges should be approximated and held with fine interrupted sutures, general surgical rules being followed. In all operations about the auricle strict antiseptic precautions are of course to be observed. If the wound involves the cartilage, with the integument on either side, it will be well to follow Dench's suggestion and place the stitches posteriorly, carrying them through the cartilage and into the skin anteriorly. The sutures are thus placed subcutaneously so far as the skin of the exposed part of the auricle is concerned. With lacerated wounds effort must be made to preserve as much tissue as possible, to avoid subsequent deformity. To this end aid is derived from the use of cold applications following the injury, thus preventing, so far as may be, severe inflammatory reaction. The case referred to in the *Journal of Laryngology, Rhinology, and Otology*, 1899, p. 270, offers encouragement to the idea of preserving as much tissue as possible. In this case the ear was completely bitten off by a vicious horse and dropped in the stable yard. No appliances were at hand, so it was simply cleansed with warm water and sewed on with ordinary sewing needles and thread. Union, with hardly any disfigurement, took place. The results of contused wounds of the ear vary from a slight inflammation to that disorganization which may follow a blow from a prize-fighter. Seen early, before extravasation of blood has taken place, cold in the form of an ice-bag or a Leiter coil is to be applied. If extravasation of fluid has occurred this is to be aspirated and the walls of the cavity held in contact by pressure of the dressings. The device suggested by Dr. G. B. Hickok and referred to by Buck serves a good purpose.

The dressings are held in place by strips of wood placed parallel to each other in front and back of the ear, and the projecting ends above and below are held together by elastic bands. It is possible to adjust the degree of pressure to a nicety, and the appliance is light. If suppuration has occurred incision must be made to evacuate the pus. The interior of the cavity should be scraped and packed with antiseptic gauze. Pressure can be maintained during healing by the appliance just mentioned.

Frost-bite. Those of us who, in our boyhood days, pursued winter sports with a zest too keen to be disturbed by tingling ears will recall the appearance of a comrade's frost-bitten ear. In the first stage, when the muscular walls of the bloodvessels were paralyzed, the ear was of a deep-red color, then with greater degree of cold became the waxy white of the really frozen ear. This, especially the white color, was likely to be true of a part only of the ear, for the condition was sure to be discovered and treatment applied before the whole auricle was frozen. The treatment, too, of applying snow while the ear was thawing out, and this out-of-doors rather than in a warm room, is the same as is recommended to-day. The aim is to restore the frozen part gradually to its normal temperature. If the part has remained frozen too long, or the normal temperature has been restored too suddenly, inflammation results which may end in perichondritis or gangrene, with loss of substance. Should this occur it must be treated on general surgical principles.

FIG. 556.

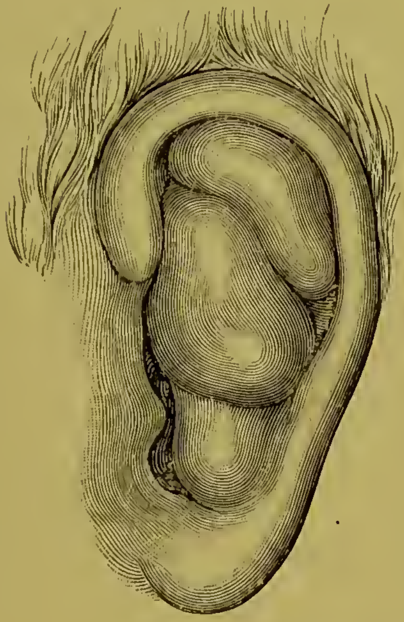

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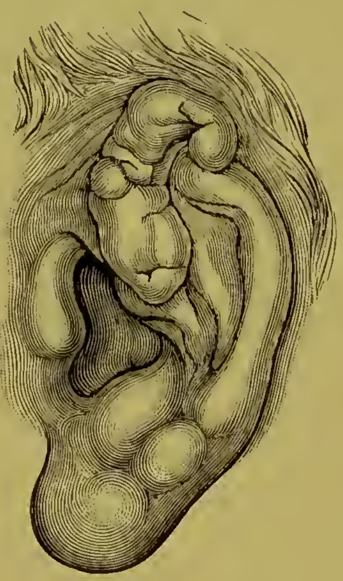
FIG. 557.



2

Othæmatoma (1) and the resultant deformity (2). (GRUBER.)

Othæmatoma, a transudation of blood beneath the perichondrium, occurs as a result of injury. It may also occur without any history of traumatism, especially in the insane. It has been claimed that the affection is peculiar to the insane, that some cerebral lesion is responsible for the changes which lead to the transudation of blood. It seems more reasonable, however, to attribute the tissue change, predisposing to othæmatoma to the debility and malnutrition of these patients and to the fact that they are peculiarly liable to violence, rather than to any pathological condition of the brain. With the more humane treatment of the insane at present, cases of othæmatoma are less frequent among them than formerly. If the case be traumatic the effusion of blood is attended by considerable pain. The swelling is usually in the upper anterior part of the ear, and the color is a bluish red. If the hæmatoma auris is of spontaneous origin it is attended by less pain, heat, and tension than when due to injury. The prognosis, in the absence of serious injury to the cartilage, is favorable. It is less favorable in case of severe inflammatory reaction necessitating incision and evacuation of the fluid, and it is to be borne in mind that deformity of the ear may result.

Treatment. If the tumor is recent, small, and painless, it should not be actively treated. If there is pain and redness, the swelling being of recent origin, cold applications are to be employed, as the ice-bag or Leiter coil. In the presence of pus or of a marked degree of tension incision should at once be made, and if the accumulation be considerable, the incision should be free, the interior of the cavity curetted, washed with an antiseptic solution, and packed with antiseptic gauze.

DISEASES OF THE EXTERNAL AUDITORY MEATUS.

Impacted Cerumen. An accumulation of cerumen is the most common affection of the external auditory canal. The glands which secrete cerumen are found almost wholly in the cartilaginous portion of the auditory canal, and when the canal is entirely filled with cerumen it is because the gradually accumulating mass has been forced into the deeper part by the efforts of the patient to clear the ear. Microscopically examined, the ceruminous glands are found to be like the sweat glands. The secretion is fluid and of a light-yellow color, and on exposure to air becomes inspissated and turns darker.

Etiology. The causes of the accumulation of cerumen within the meatus are, first, an abnormal narrowing of the external meatus which thus interferes with the free external movement of the cerumen; second, an altered character of the secretion which, being thicker and more tenacious than normal, is less readily extruded; third, increased quantity of the secretion from hyperæmia of the lining membrane of the meatus. This hyperæmia is often associated with nasopharyngeal catarrh as a reflex phenomenon. Hyperæmia of the lining of the meatus is frequently induced and maintained by the habit of digging in the ear with a pin, an ear spoon, or other foreign body. The patient's own efforts to clear the canal often result in forcing the mass, soft as it is when first secreted, inward toward the tympanum. A foreign body in the meatus to which the cerumen adheres is sometimes the beginning of an accumulation. The writer has twice in one individual found a pledget of cotton in the mass of cerumen removed. This the patient had inserted in the ear and forgotten. In another case a cherry-pit was found at the bottom of the mass of cerumen. This patient was an adult who had not the remotest idea how or when the pit was put into the ear.

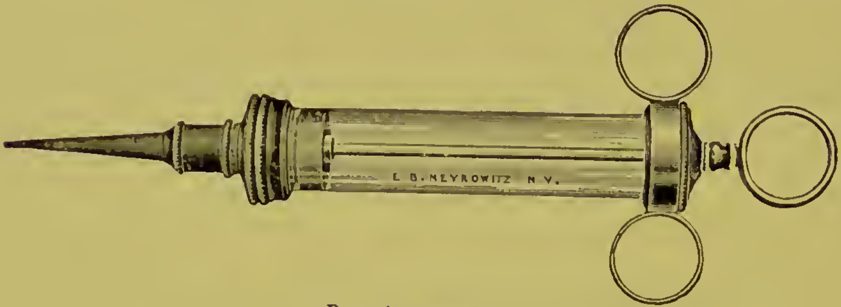
Symptoms. The symptoms vary with the amount and position of the cerumen. It is not unusual to find a large accumulation, of which the patient is wholly unconscious. So long as there is no pressure upon the drum membrane there are no subjective sounds, and if there is even a very small space between the cerumen and the wall of the meatus hearing is not impaired. On the other hand, a small quantity may be moulded by efforts at removal so as to completely occlude the meatus, and thus cause deafness. When the meatus is nearly filled with cerumen the patient may have periods of uncertain and, to him, unaccountable deafness, depending upon the closure and opening of the small passage between the canal wall and the wax. The first heated term in summer is likely to bring to one's office a considerable number of people whose hearing has become suddenly and seriously impaired by the swelling of the plug of cerumen from the moisture of perspiration. As a result of filling of the external canal there may be a feeling of confusion, even to the impairment, in some degree, of mental processes; this is a reflex symptom, and is not dependent upon loss of hearing. There is also a peculiar resonance of one's own voice—autophony. If the accumulated mass is so situated as to make pressure upon the tympanum there are subjective sensations of sound, and there may be vertigo as a result of this pressure upon the ossicular chain. The walls of the meatus are sometimes much dilated in consequence of desquamative inflammation, set up by the pressure of cerumen as a foreign body. An occasional case of chronic suppuration of the middle ear is attended by serious symptoms because of the interference with drainage interposed by impacted cerumen. When the quantity of discharge is small it slowly dries in the canal along with the cerumen into a mass of cement-like hardness. If for any reason there is an increase in the flow of pus it can find no exit, and is forced inward with risk of entering the cranial cavity.

Diagnosis. Examination with the speculum, or sometimes without the aid of instruments, shows the meatus filled with material, the color and consistence of which will depend upon the age of the accumulation. It may be a soft, pasty, yellowish-brown mass, or nearly black and of stony hardness.

Prognosis. Although the hearing is commonly restored upon the removal of the cerumen, it is yet wiser to give a guarded prognosis, as it is impossible to estimate the degree of damage which the ear may have suffered from preceding inflammatory processes. Suppuration may follow the removal of inspissated cerumen in those cases, already referred to, where chronic suppuration is attended by but little discharge. The removal of the plug does not set up the suppuration, but uncovers what has been hidden. This situation should be explained to the patient. Where the onset of deafness is sudden, as after a plunge bath, or after prolonged perspiration, a favorable prognosis can safely be given.

Treatment. In the great majority of cases the canal can be cleared more promptly and more agreeably to both patient and physician by the use of the blunt curette than with the syringe. The necessary manipulations may require more skill and delicacy of touch than are called for in syringing, yet a little careful practice ought to enable one to do this without causing the patient pain. The very exercise in such manipulations increases one's dexterity and gives him the advantage of added skill for more delicate work. Should familiarity in the use of instruments be lacking, or if the wax is soft, tenacious, and adherent to the drum membrane, then the syringe and warm water must be used. If special basins are lacking a finger-bowl may be held under the ear to relieve the outflow of water. This the patient holds while, with his left hand, the physician lifts the ear upward and backward to straighten the canal, and drives the water into it from the syringe held in the right hand. The stream of water is to be directed along the wall of the canal, preferably the superior or posterior, that the fluid may be insinuated between the cerumen and the canal wall. In this way the wax will soon be dislodged by the return flow of water. If the flow of water be directed against the centre of the mass the tendency will be to force it more deeply into the canal. There are cases in which it is next to impossible to use the syringe effectively, since the wax is very hard and fills the canal completely. Here it is necessary to tunnel a passage through the wax with the blunt curette worked carefully along the canal wall. This can be done without inflicting pain if the instrument is carried in flat and pressure is exerted only toward the wax. Having made the small passage, water can now be forced into it with good prospect

FIG. 558.



Bacon's ear syringe.

of dislodging the accumulation. After syringing the canal should be thoroughly cleaned and dried with the cotton-carrier, and, especially in cool weather, a small pledget of cotton inserted, to be removed at night and not replaced. E. L. Mierhof[1] commends the use of undiluted sulphuric ether, poured into the external auditory canal. The ether acts in a few seconds, partly dissolving the cerumen from its attachment to the canal, so that with the most gentle syringing the plug is promptly removed.

Circumscribed Inflammation. This painful affection occurs as the result of an infection, the specific germ, staphylococcus, for example, invading a hair follicle or gland. It is more likely to develop in a canal bathed in pus from a chronic otitis media, or in one which is the seat of a chronic eczema. The infection may be conveyed by the instrument which the patient uses to scratch the ear.

Symptoms. The most prominent symptom is pain, but this varies greatly in intensity, depending upon whether the furuncle is superficial or deep seated, or whether it is located in the cartilaginous or bony portion. It is most painful when deep seated and in the bony portion of the canal. Should the swelling close the canal, deafness and tinnitus result. When situated anteriorly movements of the jaw are painful; if posteriorly the pain on pressure and the swelling may suggest inflammation of the mastoid process. The ear should be examined with the utmost gentleness, as it is exquisitely sensitive to touch when thus inflamed. Reflected light without the speculum will often be sufficient to locate the furuncle.

Diagnosis. This process may easily be mistaken for diffuse inflammation of the canal or, in some cases, for mastoiditis. In diffuse inflammation the swelling is more uniform and is concentric; in furuncle it is localized, and even with more than one furuncle separate swellings can be made out with some one point of each which is most sensitive. The pain on pressure over the mastoid is found to be superficial rather than deep seated, and is greater on pressure toward the ear rather than toward the mastoid. Without treatment, or improperly treated, or if the patient is debilitated, furuncles are apt to recur.

Treatment. The use of leeches has been advised, but is of little avail in relieving pain. Hot applications are somewhat soothing; but incision is the most effective means for relieving the pain and cutting short the inflammation. Even if done before the formation of pus the lessening of tension and the bleeding following free incision have a most favorable influence. After incision the ear should be syringed with a warm antiseptic solution, and if there is any tendency toward recurrence or the formation of granulation tissue, alcoholic solution of boric acid or bichloride of mercury should be dropped into the ear. The lining of the canal may remain inflamed and sensitive following the eruption of furuncles. Besides the annoyance to the patient, this state leads the more readily to the formation of successive series of boils. It is therefore advisable to make use of some soothing ointment following the acute stage, as the diachylon diluted with equal parts of "cold cream," or, if a little later slight stimulation be indicated, ung. hydrarg. ammoniati, one part to two of "cold cream." A vigorous plan of tonic treatment is to be employed if the patient's general health is reduced.

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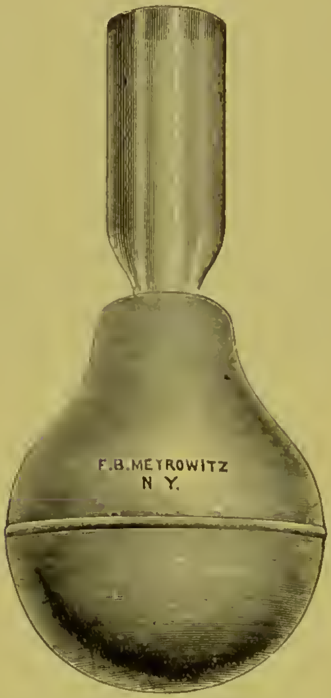
[1] New York Medical Journal, August 24, 1901, p. 351.

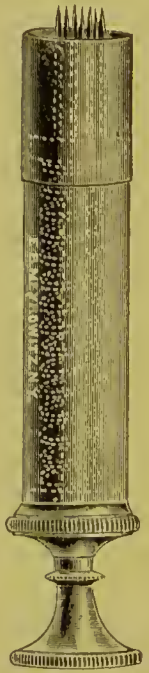
Diffuse Inflammation. This may occur as the result of injuries to the canal from scratching it with pins, hairpins, etc., the presence of foreign bodies, or rough attempts to remove them, from the instillation of irritating fluids, an acrid discharge from the middle ear, or the occurrence of fungi, etc.

Fig. 559.



Bacon's cupping glass.

Fig. 560.



Bacon's scarificator.

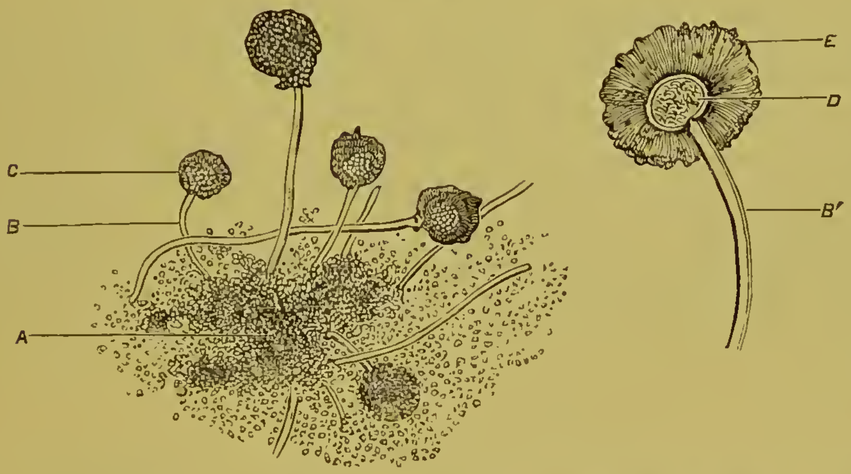
The severity of the symptoms varies with the part involved and the degree of inflammation. The pain is more severe when the osseous portion and drum are involved. The hearing is impaired in proportion to the swelling and piling up of pus and softened epithelium. After the stage of serous exudation an examination of the canal shows it to be narrow and lined with a whitish, sodden membrane made up of epidermis and pus, and filled with micrococci. The removal of the softened layer uncovers the reddened swollen lining of the canal. Promptly treated, the process may end within a few days, or it may go on to the chronic form, to the damage of the canal and the drum membrane.

Treatment. In the early stage with severe inflammation blood should be abstracted either by leeches or with Bacon's artificial leech applied near the tragus. Irrigations of the canal with a hot antiseptic solution is also advisable. If there is much swelling free incision should be made. After the subsidence of the acute symptoms the canal is to be carefully cleansed by syringing and dried with the cotton-carrier, and boric acid and oxide of zinc in equal parts should be blown in. In case of the formation of granulations, these are to be removed by the curette, and an alcoholic solution of bichloride of mercury or borolyptol instilled. Strong solutions of nitrate of silver are often applied at this stage. Constitutional treatment may be required if the patient is much reduced in general health.

OTOMYCOSIS.

Inflammation with or without discharge from the external canal may be caused and continued by the growth of fungi. The inflammation of the canal excited by this growth is termed otomycosis. The fungus most commonly found in the ear is aspergillus, of which there are several varieties; only two, however, are usually met with, aspergillus nigricans and aspergillus favescens, nigricans by far the most frequently. The growth is most likely to flourish in a canal which has been the seat of disease and contains exfoliated epithelium, or into which oily solutions have been instilled and allowed to remain. Cases are said to be relatively frequent in India under the combination of heat, dirt, and dampness. The presence of this growth maintains a chronic otitis externa and may lead to injury of the canal and membrana tympani. When the deeper layers of the skin are involved a considerable degree of pain results, and in any case there is itching or irritation. Tinnitus and

FIG. 561.



Aspergillus nigricans. *A*. Mycelium covered with numerous fallen spores. *B*. Hypha. *C*. Sporangium with ripe spores. *B′*. Hypha. *D*. Receptaculum. *E*. Sterigmata with spores. (POLITZER.)

impairment of hearing attend the filling of the canal and the inflammation of the drum membrane. The occurrence of aspergillus nigricans may be mistaken for cerumen. This error should be recognized on removal of the mass, as its consistency is not that of cerumen, and the surface exposed in the meatus is found to be red and swollen. The microscopic examination renders diagnosis certain. The prognosis is good. Treatment consists in the cleansing of the canal and the use of antiseptic solutions. Solutions of bichloride of mercury in alcohol have been much used and cannot fail to be efficient if persisted in. Considerable time is often required, however, and both the mercury and the alcohol cause much smarting in the inflamed canal. Dr. Samuel Theobold[1] recommends the insufflation of equal parts of boric acid and oxide of zinc after thoroughly cleansing the canal. In a typical case to which he refers it was necessary to repeat the application but once. This treatment is advised for the attendant inflammation of the canal as well as to destroy the fungi. Theobold has employed this treatment for seventeen years.

FOREIGN BODIES.

Foreign bodies may be found in the external auditory canal of both children and adults; but it is the ear of the child that the otologist is most frequently called upon to explore for lost treasures. The range of objects which may be found in a child's ear has no limit save that of size. In adults the occurrence is the result of accident or the entrance of an animate object, as a bug or a fly. The eggs of the common house fly are sometimes deposited in a canal containing pus. The subsequent development of the larvæ causes a condition both distressing and disgusting. Short, stiff hairs occasionally fall into the meatus and rest against the membrana tympani, and the movement of the jaw in mastication causes friction producing annoying symptoms.

Symptoms. A foreign body may lie in the meatus for an indefinite period and give rise to no symptoms. There is no lack of recorded instances of the finding of such bodies which have lain in the canal for many years. Occasionally the dislodgement of such an object, which has caused no annoyance, brings it in contact with a sensitive part, giving rise to severe symptoms. Some substances, such as beans or seeds, which swell on being moistened, cause distress, after sea-bathing, for example, or in case the canal is filled with pus from a suppurative otitis media. On the whole, however, the worst symptoms caused by foreign bodies result from the unskilful attempts at removal on the part of frightened relatives or inexperienced physicians.

Diagnosis. If the patient be seen before any attempts at removal have been made diagnosis is ordinarily a simple matter. Young children, however, are sometimes unable to say what kind of an object was inserted, and are so unmanageable that no satisfactory examination can be made. In such case the patient should be etherized, when examination and treatment are comparatively simple. In other cases the canal has been so injured by unskilful attempts at removal that the foreign body is concealed by dried blood or by the swollen walls of the canal, and the diagnosis is difficult.

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[1] Johns Hopkins Hospital Bulletin, 1898, vol. ix. p. 251.

Prognosis. The canal is quite tolerant of foreign bodies, and the prognosis depends rather upon the violence which has been done to the parts by rough attempts at removal than upon the character of the object in the canal. Should inflammation already have extended to adjacent parts, as the middle ear or mastoid, this is indicated by symptoms peculiar to involvement of those regions.

Treatment. The means to be adopted for the removal of a foreign body will depend upon its size, shape, and character, and whether the canal is much swollen. If the object is not large the syringe should be used, since it affords a prompt and painless method. If it be a seed which swells on being moistened, and is not at once removed by the syringe, instruments are to be employed. The blunt curette or the hook are here likely to be most useful. If the object be of such shape that it can be securely grasped by the slender forceps this instrument may well be used; but many foreign bodies are rounded and hard, so that the attempt to grasp them with the forceps only forces them more deeply into the canal. This instrument, therefore, must never be employed unless there is positive assurance that a good grasp can be had. When the object is round, like a glass bead, a pebble, or a fruit-pit, and large enough to quite fill the canal, directing a stream upon it from a syringe but forces it further toward the fundus. By searching carefully some point will be found where there is a little space between the object and the canal wall, and the hook carried flat can be passed behind the body, when, by giving the instrument a quarter turn, the sharp point will be in position to draw the object out. The blunt curette may perhaps be more safely used. In any event no such manipulation is to be attempted, except under good illumination. To lift a smooth, round body from the bottom of the canal the use of a camel's-hair pencil dipped in cement or thick glue has been suggested. The object and canal must be thoroughly dried that the glue may harden and sufficient time be allowed for the

FIG. 562.

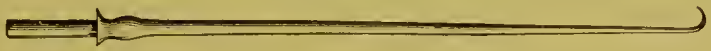
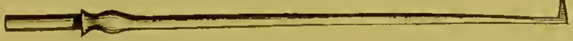


FIG. 563.



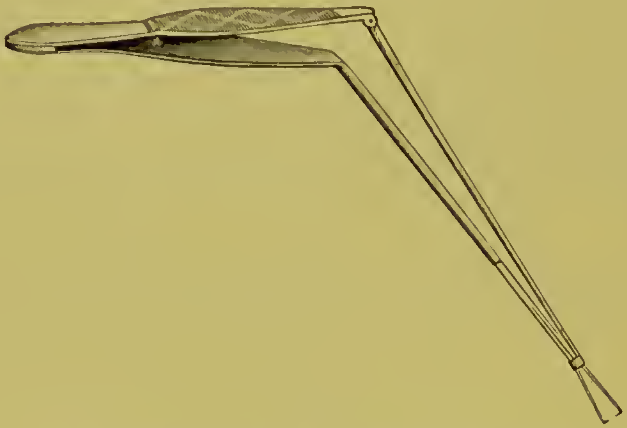
Hooks for removal of foreign bodies.

cement or glue to become fixed.[1] When the foreign body has become impacted in the bony portion of the canal and the cartilaginous portion is so swollen that the object cannot be removed by any ordinary means at command the radical procedure of displacement forward of the auricle and soft parts of the meatus must be employed. Under anæsthesia the fibrocartilaginous canal with the adherent periosteum is separated from the bone posteriorly. A transverse incision is made in the canal as near the drum membrane as possible, and the foreign body removed. Should the foreign body be too large for extraction through this opening, Dench advises that the space be enlarged by chiselling away a sufficient portion of bone.

WOUNDS OF THE MEMBRANA TYMPANI.

Wounds of the membrana tympani commonly occur as a result of the direct penetration of a foreign body or from the sudden condensation of air within the auditory canal. The membrana tympani may be ruptured in fracture of the cranial bones; but it is here a matter of trifling importance in comparison to the lesion which it accompanies. The drum membrane may be lacerated by any one of the numerous objects which patients insert into the meatus to relieve itching and irritation. An accidental movement of the earspoon, toothpick, end of a pen-holder, etc., may penetrate the membrane. The writer has seen one case in which the meatus and membrana tympani were wounded by the entrance of the tip of a branch of a tree. A young man engaged in trimming an apple tree made an unguarded movement of the head to one side and drove a small projecting branch deeply into the meatus. Another peculiar accident

Fig. 564.



Sexton's foreign-body forceps. (Two-thirds natural size.)

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[1] See Politzer, 1894, p. 223.

was sustained by a woman while walking in the country. She was upon a narrow path when bicycle riders came up behind her. She stepped aside to allow them to pass, and received a penetrating wound of the membrana tympani from a small walking stick which one of the riders carelessly carried projecting from his handle bar. Long-continued suppuration followed this accident. A large perforation of the membrana tympani remains, and the hearing is much impaired. The appearance of the wound will depend on the form and size of the object which causes the injury and upon the length to time which has elapsed before the case comes under observation. If the wound is made by a relatively large object a considerable contusion rather than laceration follows the injury, attended by subsequent inflammation and sloughing. All these wounds are quite likely to be followed by inflammation and suppuration, perhaps as a result of direct infection at the time of the accident. The symptoms attending such an accident are severe pain and tinnitus, with fainting or giddiness and loss of hearing. The acuteness of the symptoms subsides somewhat; but the pain and tinnitus again increase on the approach of inflammation. Long-continued suppuration and permanent perforation often result from these accidents. The thickening and adhesions which attend the inflammatory process result in permanent loss of hearing. The treatment to be followed in these cases is that for acute purulent disease of the middle ear.

FIG. 565.

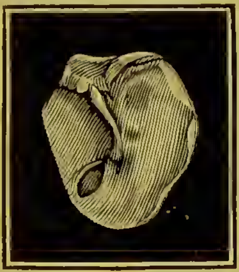


FIG. 566.

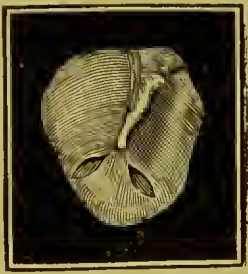


FIG. 567.

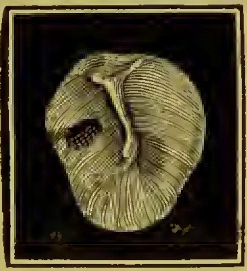


FIG. 565.—Rupture in the anterior inferior half of the membrane of a boy after a box on the ear. (POLITZER.)

FIG. 566.—Double rupture of the membrane of a woman thirty years of age, caused by a fall upon the ear. Appearance on the third day after it had taken place. (POLITZER.)

FIG. 567.—Round rupture in the anterior superior quadrant of the membrane of a girl, which was caused by a large box falling upon her ear. (POLITZER.)

Rupture of the membrana tympani from condensation of air within the meatus may be due to blows upon the ear, "a box on the ear" being the most frequent illustration of this form of injury. A fall upon the ear may cause the same form of damage, as also the impact of a wave while bathing. Explosions and the firing of heavy cannon have also caused this injury. Certain conditions of the membrana tympani favor the occurrence of this form of injury, and these are an atrophy, calcareous deposits, and cicatricial formations. Closure of the Eustachian tube, too, by preventing the ready escape of air within the middle ear, favors rupture of the membrana tympani under the conditions named. The symptoms caused by this accident are the sensation as of a loud report, great pain, giddiness, and tinnitus. The degree of impairment of hearing depends upon the damage done the labyrinth by the concussion. If this is slight the hearing will probably be but little impaired, while, if considerable, permanent deafness and tinnitus follow. The mere tear in the membrana tympani is not a serious matter, for it soon heals. If the case be examined shortly after the accident it will be quite possible to differentiate between it and an old perforation. The shape of the rupture is usually oblong, with oval sides and pointed extremities. The edges of the opening are thin, sharply-defined, and show blood-stains. Through the opening the inner wall of the tympanic cavity is seen, not changed in color by inflammation, and thus differing from the appearance in ordinary perforations. Politzer says that upon inflation by the Valsalvan method air passed through the ear much more freely than in the case of ordinary perforation, and, instead of the high-pitched hissing sound, there is a free, deep, blowing sound if the accident has happened to a normal ear. If the case is not complicated by concussion of the labyrinth the course followed is usually favorable. Only rarely does suppuration occur, and this is commonly attributed to unwise and too active efforts to aid the healing process by the use of instillations. Permanent openings are more likely to result from such interference than if the case be left alone. Treatment consists in non-interference beyond simply sterilizing the external portion of the meatus and protecting the tympanic cavity by the use of sterilized cotton worn in the meatus.

CHAPTER XXVI.

DISEASES OF THE INTERNAL EAR AND AUDITORY NERVE; DEAF MUTISM.

BY E. A. CROCKETT, M.D.

Anatomy and Physiology. The internal ear consists of the cerebral portion of the auditory nerve, its trunk, and its endings in the labyrinth, the latter consisting of the osseous labyrinth, enveloping the vestibule, three semicircular canals, and the cochlea, together with the membranous labyrinths contained within the former, the saccule and utricle, membranous semicircular canals and membranous part of the cochlea. The foramen ovale opens into the vestibule, as also do the mouths of the three semicircular canals, by two openings, the superior and posterior opening as one. The vestibule itself is an irregular cavity from 4 to 6 mm. in its different axes.

The semicircular canals lie embedded in the petrous portion of the temporal bone, on the upper surface of which the superior project as the eminentia arcuata. They lie in three planes, superior, posterior, and horizontal. The exterior portion of the latter projects into the inner wall of the tympanic cavity behind the Fallopian canal. Each canal is dilated at its beginning into the so-called ampulla.

The cochlea is a canal about 30 mm. long, turning two and one-half times around a central axis. It communicates with the vestibule and also, by means of the fenestra rotunda, with the tympanum. It is embedded in the petrous portion of the temporal bone between the internal auditory meatus and the carotid canal, with its base toward the internal auditory meatus and apex toward the tympanic cavity. On a vertical section of the cochlea we see the modiolus or central canal, and on its surface an osseous plate—the lamina spiralis ossea—beginning between the fenestra rotunda and the vestibular orifice of the cochlea and running spirally to the cupola, where it ends in the pointed hamulus. By this ridge the canal of the cochlea is subdivided into the scala vestibuli, communicating with the vestibule, and the scala tympani, communicating with the tympanum by the fenestra rotunda. The two scalæ communicate with each other at the apex of the cochlea by the helicotrema.

The membranous labyrinth follows in most part the contour of the osseous, just described. The membranous vestibule is subdivided into the utricle and the saccule. The utricle communicates with the semicircular canals by five openings, the saccule with the ductus cochlearis. Between both and the lateral wall of the vestibule is a very considerable space filled with perilymph. The form of the membranous semicircular canals is exactly that of the osseous, and they fill the cavity of the latter about one-third. They are stationary, being fastened to the sides of the osseous canals by connective tissue, and the intervening space is filled with perilymph.

The most complex structure found in the internal ear is the membranous structure and termination of the auditory nerve in the cochlea. Springing from the free edge of the lamina spiralis ossea to the projecting ligamentum spirale of the opposite wall is the membranous spiral lamina. This divides the canal of the cochlea into the scala vestibuli and scala tympani, and the former is again divided by the membrane of Reissner, which extends obliquely from the lamina spiralis ossea to the external wall into two canals. One of these, the canalis cochlearis, formed by the membrana basilaris, external wall of the cochlea, and membrane of Reissner, communicates with the saccule and ends in a cul-de-sac at the top of the cochlea, and contains the elaborate structure known as the organ of Corti.

An exact understanding of the mechanism by which the sound-wave is transmitted from the middle ear to the brain is impossible with our present knowledge. The vast majority of observers believe that the sound-wave reaches the labyrinth by way of the base plate of the stapes rather than *via* the round window. The perilymph, being an incompressible fluid contained in an unyielding medium, receives repeated shocks from the piston-like motion of the stapes' base plate. These shocks are first received by the perilymph of the vestibule, then by that of the scala vestibuli, then by way of Reissner's membrane to the endolymph of the ductus cochlearis. By the vibration imparted to the lamina spiralis membranacea these shocks are received by the perilymph of the scala tympani, and the outward and inward movement of the membrane of the round window completes the circle. Presumably the end organ of the auditory nerve is to be found in the cells of Corti's organ, and each cell vibrates in sympathy with a fixed tone, and no other.

As to the semicircular canals, the results of Flouren's early experiments have been accepted by most writers to prove that they possess no part in the perception of sound, but are organs of equilibration.

The organ of Corti lies in the zona arcuata and consists of an inner and outer layer of fibres, the lower portion resting on the membrana basilaris, and the upper ends are connected together. The outer row present on their upper ends lamelliform processes on which is fastened the lamina reticularis. The cilia of Corti's cells project through the openings of the lamina reticularis, the lower portion of the cells resting on the membrana basilaris, and they are connected with the auditory nerve by thin filaments.

No exact part in the perception of sound has been ascribed to the vestibule, although some observers think that the otoliths may act as dampers in diminishing the force of the sound-wave.

The exact course of the auditory nerve before it enters the petrous portion of the temporal bone is still in dispute. It arises in the medulla oblongata between the facial and glossopharyngeal nerves, and is easily divided into two sections; the lower branch supplies the cochlea, entering at the modiolus, and also sends a branch to the saccule and ampulla of the vertical semicircular canal. The upper branch enters the vestibule and supplies the utriculus and the ampulla of the semicircular canal.

The blood supply of the internal ear is derived from a branch of the basilar artery, which enters the internal auditory meatus with the auditory nerve. The return supply is into the inferior petrosal sinus, and there is an anastomosis with the tympanic vessels through the external labyrinthine wall.

DISEASES OF THE INTERNAL EAR.

These are primary and secondary, and have been considered as forming a small proportion of the total number of ear diseases; but it is certain that the more careful the observation the greater the number of labyrinthine cases recorded.

The most common primary diseases of the internal ear are hemorrhages from fractures of the temporal bone, and from the active changes common in nephritis, diabetes, and syphilis, and injuries to the auditory nerve, either in its course or termination, by blows on the head, or pressure of new-growths.

By far the most common secondary disease is the invasion of the vestibule by osseous changes in the neighborhood of the base plate of the stapes. Purulent processes in the labyrinth by extension of a middle-ear suppuration are a rare but very serious complication.

Fractures of the petrous portion of the temporal bone may cause deafness by a direct solution of continuity of some portion of the auditory nerve, or from the resulting hemorrhage destroying the nerve fibres. Infrequently, severe head injuries may cause hemorrhages into some portion of the internal ear, without fracture of the temporal bone. The symptoms in both these conditions are essentially the same. The deafness is practically complete in the extreme cases, although, as a rule, aerial tone-perception may remain for some portion of the scale. In the less severe, a portion of the musical scale may be struck out, usually in the high tones, the remainder being unaffected. With this deafness, which is commonly at its maximum immediately, are associated vertigo, nausea, or vomiting, and a loud and persistent tinnitus. In severe cases the vertigo may be so extreme as to prevent the patient's moving even from side to side in bed, or walking without support, for one or two weeks, and in such cases the vomiting is very persistent and may necessitate rectal feeding. These severe cases are, of course, apt to be confused with the cerebral symptoms of head injuries; but the association of vertigo, nausea or vomiting, tinnitus, and deafness in the absence of other cerebral symptoms should make the diagnosis of the average case perfectly clear.

In such patients the prognosis as to the relief of symptoms is very important in a medico-legal way. The deafness is almost always incurable and permanent, but non-progressive. The vertigo and tinnitus, especially in cases where only one labyrinth is involved, often annoy the patient more than the deafness, and it is extremely difficult to be definite as to the length of time they will persist, except by watching the course of the case. The vertigo often remains for months, gradually diminishing in intensity, and the tinnitus is frequently a matter of years. Occasionally nystagmus will be observed in labyrinthine injuries and also in operative interference with the stapes base plate.

A precisely similar symptomatology is observed in the hemorrhages from arterial degeneration in syphilis, nephritis, diabetes, and the severe anæmias. Where the hemorrhage is large the deafness is extreme, and the nausea, vomiting, and tinnitus severe. In these persons the attack is often apoplectiform; the vertigo seizes the patient when he is pursuing his usual occupation or while asleep, often he falls to the ground without any warning, with severe vomiting lasting two or three hours. Such cases are often wrongly diagnosed as cerebral hemorrhage; but in the absence of any loss of consciousness or of any local paralysis, the group of symptoms is plainly aural.

While the severe cases are relatively rare, milder forms are common in the practice of every aurist. Transient attacks of giddiness with tinnitus, but no nausea, are quite common in arterial degeneration, and, as the accompanying deafness may be in the upper registers only, it is frequently overlooked. In such cases the ear complication may be the first symptoms of the general disorder and, of course, any treatment must be general and not local.

This group of symptoms coming on in the course of syphilis is much more common than is supposed, and may be either hereditary or acquired. The latter comes either in the late secondary or tertiary stages, sometimes ten or fifteen years after the primary lesion. Such cases usually yield to appropriate syphilitic treatment, and also show a remarkable temporary improvement under the use of pilocarpine either by mouth, or better, subcutaneously in full doses of one-eighth to one-quarter grain once or twice a day. It must not be forgotten that this is only a transient improvement, and should be supplemented by the regular treatment for the usual length of time. In these syphilitic cases, especially in the tertiary lesions, a correct diagnosis is often not made for a long time, and unless the proper treatment is begun within a week of the onset of the ear symptoms, improvement in hearing must not be expected; but the use of pilocarpine will relieve the vertigo months after the occurrence of the attack.

This same group of symptoms is often present in slight labyrinthine degeneration from any cause. This is particularly true where a thickening exists about the stapes base plate or the membrane of the round window, so that the mobility of one or both of these structures is affected. Where there is any increase of pressure in the labyrinth compensation cannot be made, as is usual, by the outward movement of these structures, and vertigo results. The increase of deafness may be slight, but is always perceptible. Numerous attacks of vertigo from this cause are observed in the course of fixation of the stapes in middle-ear thickening.

Suppurative Processes in the Internal Ear. These processes are always secondary to middle-ear suppurations and form a rare complication of this disease. The course of the purulent inflammation is usually through the foramen ovale or the foramen rotunda, and the labyrinth alone may be involved; but often the purulent process extends to the middle cerebral fossa through the internal auditory meatus.

In acute purulent invasions of the labyrinth the symptoms are unmistakable—the vertigo is very severe, with vomiting lasting for hours. In two cases which the writer has seen the vomiting was so extreme as to necessitate rectal feeding for two or three days. The deafness is, of course, total soon after the onset of the attack.

If the process extends through to the cerebral fossæ the symptoms of meningitis follow those of the labyrinthitis in from twenty-four to forty-eight hours.

In invasion of the internal ear as a result of chronic suppurative processes, the characteristic symptomatology is absent in most patients, and we merely find a deafness of a higher grade than can be attributed to an uncomplicated middle-ear suppuration.

In removing sequestra from the middle ear or mastoid the operator will occasionally find portions of the labyrinth in the destroyed bone, and a number of cases of removal of the whole labyrinth have been reported. These slow suppurations are usually the result of neglect of the preceding middle-ear process, and are observed more frequently after neglected scarlet fever or diphtheria or in the course of tuberculosis of the temporal bone; but they may occur from infection with any of the pathogenic bacteria.

In chronic caries and necrosis infection of the meninges is much less likely than in the acute processes, owing to the thickening of the dura over the diseased bone.

In any extensive caries of the petrous portion of the temporal bone the facial nerve is almost certain to be paralyzed, and this may be the first symptom leading us to suspect that a simple acute middle-ear suppuration has become converted into a more serious affair. Such a paralysis may be partial or total, according to the extent of the injury.

Involvement of the facial nerve must not be considered as diagnostic of labyrinthitis, as the nerve may be involved in the tympanic portion, and especially in the neighborhood of the mastoid antrum.

In the absence of symptoms of meningitis, cerebral abscess, or thrombosis of any of the cranial sinuses, the prognosis of caries of the labyrinth under treatment may be considered good. The fatality is much higher in the acute cases than in the chronic. The prognosis as to hearing is absolutely bad, although a few cases have been reported where some trace of hearing remained after exfoliation of the cochlea. The facial nerve will occasionally resume its functions, even after very extensive sequestra have been removed.

The treatment of such cases must be determined by the symptoms of the individual patient. In acute infection of the internal ear from the middle ear the most radical surgery should be resorted to in view of the much higher fatality.

In the more chronic cases, and especially in young children, an expectant treatment by syringing and ordinary surgical cleansing may be advisable until nature has established a definite line of demarcation, as in such cases the risk of setting up cerebral inflammation or of wounding the internal carotid artery at some point of its course through the petrous portion of the temporal bone is much diminished. There can be no question about the immediate removal of sequestra, no matter what their size and position, and this will usually be found a simple matter. Such sequestra are of all sizes and shapes, and involve either the whole labyrinth or any portion. Where no septic or cerebral symptoms exist cleansing the ear by frequent syringing until demarcation is established is often the most rational surgical procedure.

Sixteen cases of fatal hemorrhage from the internal carotid artery have been reported. In all instances some portion of the carotid canal was carious, and in all there was a direct communication between it and the tympanic cavity. In each a neglected middle-ear suppuration had existed for a long time, and the first symptom was profuse hemorrhage from the external canal. In most cases the bleeding was so severe as to leave no doubt as to the diagnosis, as a solid jet of blood issued from the external meatus, and there was also free bleeding into the throat by means of the Eustachian tube; in only a few patients a persistent oozing gave the first warning of the later severe hemorrhage. The possibility of this contingency should suggest itself in the removal of all large sequestra of the petrous portion of the temporal bone. The only rational treatment of such complication is the immediate ligation of the internal carotid artery.

Neuroses. 1. **Hyperæsthesia.** A certain amount of hyperæsthesia is normal to all persons, usually in the upper register, as, for example, the upper tones of the Galton whistle, the scratching of a slate-pencil, etc. This, of course, is greatly increased in neurasthenia or in convalescence from exhausting illness, anæmia, general nerve strain, etc. It is also exceedingly common in some middle-ear diseases, especially in the early stages of the fixation of the stapes. In some instances the symptom persists even after the patient has become so deaf as to be unable to perceive articulate sounds.

Local treatment is naturally of little avail, and attention should be directed to relieving the general condition of the patient and to removing the particular exciting cause of the symptom wherever possible.

2. **Subjective Sensations of Hearing.** Noises in the head or ears are, of course, one of the most common of all the symptoms of ear disease, whether the process is one of the external, middle, or internal ear; but we frequently also see a purely functional tinnitus, and it is of the latter only that this section treats.

The sensations of sound may be directly referred to one or both ears, or may be referred to any portion of the head, and may be continuous or occur in attacks. When the patient has a subjective tinnitus it is invariably increased by any cause which stimulates his labyrinthine circulation, either by taking of drugs like quinine or salicylic acid, by alcohol, by sleeplessness or nerve strain, worry, indigestion, or many similar causes. A tinnitus of this description occurs in a person with healthy ears, and may continue indefinitely. The tinnitus is seldom of the severe variety seen in the middle and internal-ear diseases, but usually is a steady sizzing sound, like escaping steam, although any of the different varieties may be observed. In some cases the sound starts immediately after a severe mental shock, and continues for years. As a rule, it is heard only when the person is quiet; but in a few instances it is augmented by surrounding noises.

Such tinnitus may last through a patient's whole life without any disturbance of the hearing function, and is almost certain to last for a number of years, unless some definite physical cause is found and remedied.

It should, however, be remembered that a persistent tinnitus may be the early symptom of a middle-ear disease, and especially of a primary fixation of the stapes, and may precede any other symptom by a number of months. It is well, therefore, to keep such cases under observation until this possibility has been ruled out.

The treatment of pure functional tinnitus is very unsatisfactory, unless the particular cause can be made out and relieved. As in the great majority of cases a faulty mode of living is the cause, and as such is almost necessary to the success of the individual under the conditions of our modern civilization, we are forced to the conclusion that the tinnitus in such instances must continue or the patient's natural ambition be sacrificed. In severe cases it may be necessary temporarily to resort to the use of drugs to relieve the tinnitus or the insomnia; but, needless to say, such treatment should be used with great caution and never continued for a long period. In a few instances relief may be obtained by inflation of the tympanum or by some form of aural massage, especially the tragus pressure of Hommel. This is especially the case in functional tinnitus following concussion of sound, as in artillery practice or trap shooting. The author has been unable to obtain any permanent benefit from the use of electricity or vibrating massage with instruments of the vibraphone type or by the old treatment of counter-irritation.

Anæmia is a condition frequently causing functional tinnitus, as also do insomnia and overwork in all the conditions. If the underlying cause is corrected at once the symptoms may be relieved, but if the neurosis becomes fixed it is much less likely to be remedied.

3. **Functional Paralyses.** Besides the organic paralysis from various causes elsewhere mentioned, there is no doubt that functional paralyses, either partial or total, exist, and such, for the lack of a definite understanding of the pathology, are usually considered vasomotor or hysterical.

From the standpoint of the clinician the vasomotor affections seem to be quite common in neurotic subjects, and are usually characterized by a transient vertigo, nausea or vomiting, tinnitus and deafness. The deafness is often of a very high grade, but seldom continues longer than a few hours. Such patients are liable to repeated attacks from any cause which may increase the intralabyrinthine circulation, and, as the attack is usually of brief duration, treatment is seldom necessary at the time.

Hysterical deafness is quite rare, and is usually comparatively easy of diagnosis from the occurrence of the characteristic labyrinthine symptoms with general manifestations of hysteria. Local anæsthesia of the membrana and auricle has been reported in a number of such cases.

4. **Paracusis and Diplacusis.** Inability to hear pitch correctly is usually due to an abnormal tension or relaxation of some portion of the middle-ear apparatus, but may be from affections of the auditory nerve either in its course or termination in the labyrinth. Where not of middle-ear origin it is more likely to be central than labyrinthine. Paracusis of Willis is always of middle-ear origin.

Diplacusis also is by the great majority of writers considered of middle-ear origin, but it may be central.

Tumors in the Internal Ear. Primary neoplasms of the labyrinth are rare; but they are not especially unusual in the course of the auditory nerve before it enters the internal auditory meatus. The new-growth when found will usually be an extension from surrounding parts and the diagnosis easy. The usual symptoms of increased labyrinthine pressure, vertigo, nausea, and tinnitus are often absent, and only the deafness shows the extension of the disease to the labyrinthine structure. The facial nerve is generally involved with the auditory, owing to their intimate relation.

The malignant neoplasms are the most frequent, both epitheliomata and sarcomata; but the benign tumors are occasionally seen, a number of cases of fibroma and angioma being on record. All of the labyrinthine tumors are inoperative, but the possibility of gumma should make a course of syphilitic treatment always advisable before the case is regarded as hopeless.

DISEASES OF THE AUDITORY NERVE.

This nerve is apparently rather rarely involved in intracranial growths, but such cases are occasionally seen. The diagnosis is, as a rule, difficult, owing to the absence of symptoms. The vertigo, nausea, and tinnitus invariably seen in the diseases of the labyrinth are usually absent where the trunk of the nerve only is involved, and deafness is the only symptom noticed. Purulent infiltration into the nerve is occasionally seen secondary to a purulent meningitis, but the most common lesion is atrophy. This is seen after pressure from intracranial neoplasms, and has also been reported as a complication of disease of the spinal cord, particularly tabes. Degenerative processes in the auditory nerve are also reported by a number of observers after long-continued disease of the labyrinth; but this is not as common as atrophy in the ganglionic layers of the cochlea.

DEAF MUTISM.

Deaf mutism may arise as a sequel of many diseases of the ear, and is either partial or total. In partial deaf mutism the whole interference with the passage of the sound-wave may be in the middle ear; but in the total cases the labyrinth is always involved. In considering the etiology of mutism we must remember that more or less disturbance to the speech function must result from extreme deafness at any time of life, but that mutism only results from deafness incurred before the speaking age, or before the fifth or sixth years, when the child may forget what words it has already acquired. In an examination of some two hundred individuals in a deaf mute institution, recently made by the writer, it was found that nearly 50 per cent. were deaf from some easily prevented cause, either the suppurative diseases resulting from scarlet fever, measles, or the other child affections, or from the adhesive middle-ear processes set up in consequence of the presence of adenoid vegetations in the pharynx. The other 50 per cent. were largely the sequel of an epidemic of cerebro-spinal meningitis which had prevailed in New England some years before, and a few cases were the result of pneumococcus and other infections of the auditory nerve in the course of acute diseases in early life. In the entire 200 cases there were only 2 in which the absence of an easily assignable cause made the probability of a direct inheritance possible. It is the writer's belief that these statistics are fairly representative, and that a careful analysis of cases will show the process causative of the deafness to be acquired and not hereditary in the vast preponderance of patients. Pneumonia in infancy, cerebro-spinal meningitis, and adenoid vegetation in the nasopharynx are the three most common causes of deaf mutism. Next to these come head injuries and inherited syphilis.

The **diagnosis** of this affliction may present many unexpected difficulties, particularly in young subjects. By far the largest number of cases will be brought to the aurist about two or two and one-half years of age, because they have not yet begun to talk. In these the first and most important consideration is as to whether the case is not one of delayed development, and this consideration alone should deter one from making too positive a diagnosis. In older children we must be most careful to eliminate the factor of lip-reading which many a deaf child acquires instinctively at an early age, and at which they become very proficient.

In testing hearing at any age allowance must be made for the perception of vibration in all loud sounds, and particularly in those of a low pitch.

In children of two or three years of age or younger a diagnosis will often be impossible at a first visit where the physician is a stranger to the child; but much may be learned by a careful observation of the patient in its own home or in surroundings familiar to it. At these ages hearing-tests can only be made with sounds, and especially with sounds incapable of imparting perceptible vibrations to surrounding objects. A whistle is one of the best tests at this time, or striking the edge of a tumbler or finger-bowl with metal. At five years old or over the voice will be the best test, and we may try tone-perceptions by the tuning-fork and the Galton whistle. With the voice vowel sounds are naturally better perceived than consonants, and the physician should pronounce the vowels one after another with the lips fairly close to the patient, or, better, through a conversation tube, having the child repeat the sounds. A, E, and O will be found the most readily heard of all. If the vowel sounds are perceived the case should then be tried in the same manner with simple words, and in all patients old enough to answer correctly, an exact measure of hearing should be obtained by tuning-forks, and, whenever possible, by some exact instrument like Bezold's tone series. It should be remembered that the case may be deaf in one portion of the scale and hear relatively well in the other portions. As a matter of clinical experience, total deafness will be found very rare, as perception of sound in some portion of the musical scale is present in nearly all cases. Testing with tuning-forks by bone conduction will be found impossible in all young and most adult patients, owing to their inability to discriminate between vibration and tone perception.

The exact definition of the amount of deafness present in the individual patient is exceedingly important, as even a portion of the musical scale may be utilized in the education of the child.

High grades of deafness are also caused by neglected suppurative middle-ear diseases in childhood, and in such cases deaf mutism may result. Appropriate treatment in these cases may yield unexpected results, and the middle ear should always be brought to as normal a point as possible before the case is abandoned as hopeless.

Treatment is often of more importance in the early stages of deaf mutism than is ordinarily supposed. It has been the author's experience that all cases of cerebro-spinal, pneumococcus, and mumps infections of the auditory nerve and labyrinth are incurable as far as treatment goes. The prognosis in the head injuries, of course, depends upon the severity of the injury in the particular instance under observation, and if the damage done is not too great the nerve may recover itself and resume its functions.

The affections of the auditory nerve in consequence of inherited syphilis are also very intractable; but if the case is seen early a thorough trial of the usual remedies for syphilis should be made before it is abandoned.

The **prognosis** of the lesions resulting from adenoid disease in the nasopharynx is much more hopeful, and the growth should always be removed in all patients at whatever age they are seen. In the cases operated on before three or four years of age a great improvement may be expected in many instances. The author has had several such cases which obtained nearly half the normal hearing, and were able to attend the public schools instead of special institutions for the education of the deaf.

Where, after a careful examination, the deafness is decided to be hopeless, so far as treatment is concerned, or where the appropriate treatment fails to show any result, the future education of the child should be considered; but the child should never be referred to a special institution for the education of the deaf until it is decided that there is not a sufficient amount of hearing to enable it to be educated in the ordinary way, and that it is impossible to obtain such hearing by treatment.

As has been before mentioned, many deaf mutes are instinctive lip readers, and in all instances where treatment is of no avail the individual should be specially educated in this method, beginning, whenever possible, at the usual school age. In this country this education is easily obtained by even the poorest children at some one of the special institutions which are found in nearly every State.

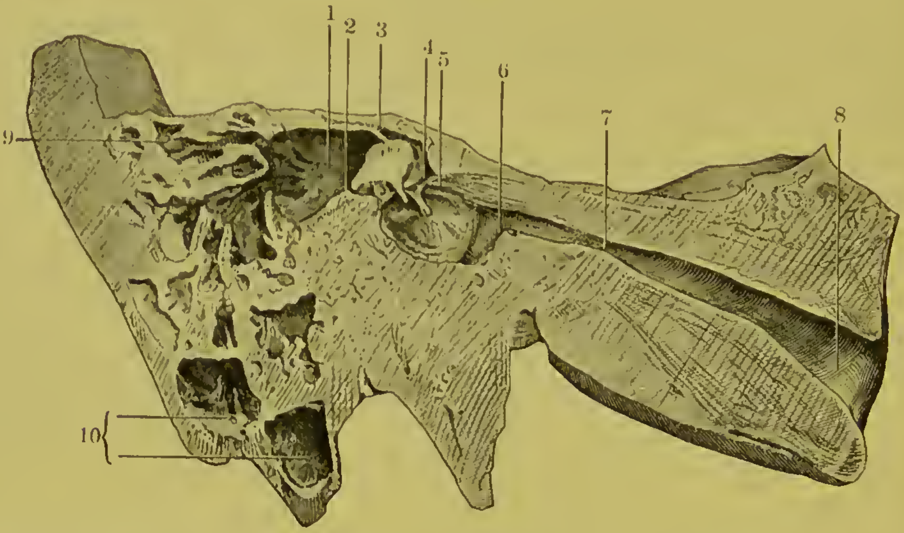
CHAPTER XXVII.

PURULENT INFLAMMATION OF THE MIDDLE EAR.

By HENRY ARNOLD ALDERTON, M.D.

In taking up the subject of purulent inflammation of the middle-ear structures it is presumed that the reader either has already acquired a working knowledge of the anatomy and physiology of the organ of hearing, or else has at command modern text-books treating of anatomy and physiology, to which he can refer. Briefly, the middle ear (Fig. 568) begins at the pharyngeal mouth of the Eustachian tube as a canal with walls which are internally partly cartilaginous and partly membranous, and externally become entirely osseous up to their entrance into the cavity of the tympanum by an aperture in the anterior wall quite a little above the floor. The cavity of the tympanum is completed externally by the drum membrane and the downward extension of the superior wall of the osseous external auditory canal (Fig. 569), and internally by the petrous

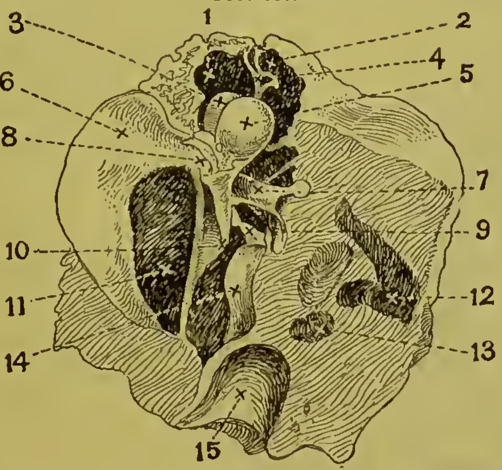
Fig. 568.



View of the middle-ear cavities from within. 1. Mastoid antrum. 2. Posterior ligament of incus. 3. Suspensory ligament of hammer and incus. 4. Opening in the plica transversa. 5. Tendon of the tensor tympani muscle. 6. Openings of cells around tympanic orifice of the Eustachian tube. 7. Isthmus of tube. 8. Pharyngeal mouth of tube. 9. Superior posterior horizontal cells of mastoid process. 10. Large cells in tip of mastoid process. (From Siebenmann's Anatomy of the Middle Ear and Labyrinth.)

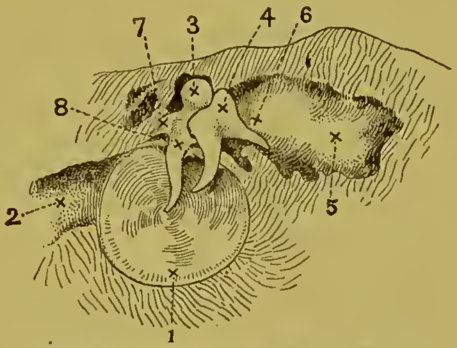
portion of the temporal bone. Posteriorly, at the superior angle, another bony canal, the *aditus ad antrum* (Fig. 570), communicates with the mastoid antrum, from which diverge in various directions, mostly downward and backward, communicating cells between the outer and inner tables of the skull. (Fig. 568.) These cells extend for varying distances in different skulls, even into the adjacent occipital bone. The tympanic cavity is lined throughout by mucous membrane, and its walls, except for the membranes of the drum membrane proper, the round and the oval window, and the cartilaginous portion of the Eustachian tube, are of bone, unless, as sometimes happens, Nature had failed to complete her work and has left here or there an aperture in the bony casement closed only by fibrous membrane. Such apertures, or dehiscences, sometimes leave exposed important structures, as, for instance, the jugular vein, the carotid artery, the facial nerve, the sigmoid sinus, or, occurring in the roof of the tympanum or mastoid antrum, the dural covering of the intracranial contents.

FIG. 569.



View of tympanum from in front. 1, 2. Attic. 3. Incus. 4. Suspensory ligament. 5. Hammer. 6. Pars epitympanica and wall of external ear canal. 7. Tendon of tensor tympani muscle, 8. Shrapnell's membrane. 9. Incudo-stapedial articulation. 10. Umbo. 11. Tympanic membrane. 12. Internal auditory canal. 13. Turn of cochlea. 14. Promontory. 15. Carotid canal for the carotid artery. (From specimen in the author's collection.)

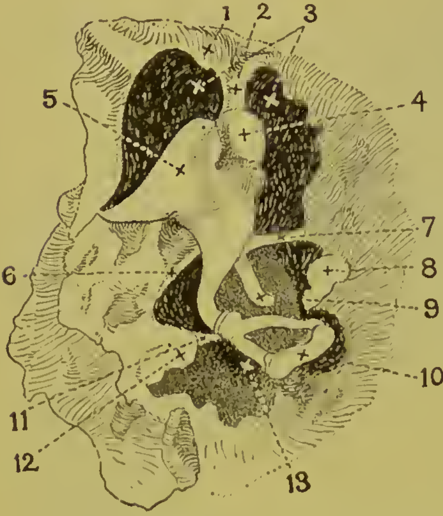
FIG. 570.



View of membrane and ossicles from within. 1. Membrana vibrans. 2. Eustachian tube. 3. Hammer. 4. Incus. 5. Antrum 6. Aditus. 7. Tensor tympani tendon. 8. Chorda tympani nerve (From specimen in the author's collection.)

Within, or passing through the tympanic cavity, are the ossicles or small bones of the ear, the chorda tympani nerve, the tendons of the tensor tympani and stapedius muscles, and various folds or bands of mucous membrane. (Fig. 571.) Outside of the bony casing of the middle-ear cavities lie those structures the presence of which, in such close contiguity, renders any purulent inflammation of the middle ear a factor of the greatest gravity. Such are the cerebrum, the cerebellum, the lateral and sigmoid sinuses, the bulb of the jugular vein, and the carotid artery. That the existence of such a purulent inflammation of the middle ear is a matter of grave importance is shown by the fact that investigation of the mortuary statistics of one of the largest general hospitals has shown that one death in every 158 resulted from the complications arising from this condition.

FIG. 571.



View of tympanum from behind and within. 1. Tegmen. 2. Suspensory ligament 3. Attic. 4. Hammer head. 5. Incus. 6. Chorda tympani nerve. 7. Tendon of tensor tympani muscle. 8. Eustachian tube. 9. Manubrium. 10. Stapes. 11. Tendon of stapedius muscle. 12. Pyramid. 13. Tympanic membrane. (From specimen in the author's collection.)

During the ten years immediately preceding 1901 there were 36,489 ear cases treated at the Brooklyn Eye and Ear Hospital; 9765, or about 27 per cent., of these were afflicted with some one of the different purulent diseases of the middle ear; 3347, or nearly 9 per cent., had the disease in its acute form; 6418, or nearly 18 per cent., had the disease in its chronic form. Besides these there were 1425 cases, or nearly 4 per cent., showing cicatricial conditions, evidently the result of a healed suppurative process. In other words, about 31 per cent. of all ear cases applying for treatment at the Brooklyn Eye and Ear Hospital were sufferers from conditions directly connected with suppurative processes in the middle-ear cavities.

As might logically be presumed, purulent otitis attains its greatest prevalence in childhood; but no age can claim immunity. The acute processes are as likely to invade one ear as the other. At the Brooklyn Eye and Ear Hospital during the year 1900, 1022 cases of purulent otitis media presented themselves. Of these 490 were in females and 532 were in males. This slight discrepancy may easily be accounted for by the extra hazards usually attendant upon occupational and playful pursuits. Sex, as such, does not, therefore, seem to influence the appearance of purulent otitis.

There would seem to exist in certain families an hereditary tendency to purulent middle-ear disease, mostly in connection with the strumous and tubercular diatheses, or with various pathological conditions of the nasopharyngeal tract, notably lymphoid hypertrophy. Pre-existing affections of the middle ear or of the external auditory meatus would also seem to exert a predisposing influence.

Usually the middle-ear inflammation follows closely upon or is coincident with an inflammation involving the nasopharyngeal cavities. Such conditions obtain as the result of an acute coryza, of teething, scarlet fever, measles, smallpox, diphtheria, influenza, whooping-cough, syphilis, etc. Occasionally the disease is induced by a draught of cold air penetrating the external auditory meatus, or by the entrance of cold water into the same canal, in swimming or diving. Injuries to the hearing organ may likewise be causative. Thus, fractures of the temporal bone, forcible entrance of water in surf-bathing, blows over the auricle, entrance of fluid into the tympanum while bathing, using the nasal douche, snuffing of liquids into the nose, forcing of vomited matters into the tympanum, and finally, intratympanic operations. Among other causes we have to reckon with mumps, phthisis, typhoid and typhus fever, pneumonia and bronchitis, diabetes, malarial diseases (Barr), tuberculosis, erysipelas, and the puerperal state (Bacon), local manifestations of acute articular rheumatism (Wolff), and carcinoma auris.

The relation of scarlet fever, measles, and diphtheria to purulent otitis media is of such importance as to warrant special consideration even in such a brief article as this must necessarily be. Arthur B. Duel, of New York, because of his connection with the New York Health Board, has had exceptional opportunities for investigation along this line, and it is mainly from his article that the following facts have been gleaned. He states that a purulent middle-ear inflammation may appear at any time during the course of these diseases. That it occurs in about 20 per cent. of the cases of scarlet fever, in 10 per cent. of the cases of diphtheria, and in 5 per cent. of the cases of measles; while in those cases in which the two diseases scarlet fever and diphtheria were combined, the percentage of cases of purulent otitis media mounted up to between 30 and 40 per cent. In measles, the ear trouble usually pursues a milder course than in the other two diseases. In diphtheria it is usually more severe than in measles, but less severe than in scarlet fever, is more likely to make its appearance during the acute stage, and in over half the cases is bilateral. In scarlet fever, the discharge is much more likely to appear later in the disease, about the second or third week, and, being of a much severer type, is prone to cause much destruction of the tympanic structures. In all of these diseases, measles, scarlet fever and diphtheria, the tendency is toward the involvement of both ears.

The following micro-organisms have been found in the discharges in cases of purulent otitis media: the streptococcus pyogenes, the staphylococcus pyogenes albus and aureus, Fränkel's pneumococcus or diplococcus, Friedländer's pneumobacillus, the tubercle bacillus, and the bacillus pyocyaneus. In the majority of cases the infection is, or soon becomes, a mixed one.

Beginning with a more or less active congestion of the mucous membrane coating the middle-ear cavities, induced by the various above-mentioned causes, there succeeds an infiltration of the tissues with blood corpuscles and round cells, producing swelling, and this is followed by an exudation from the free surfaces of the mucous membrane. At times, especially in influenza, rupture of the over-distended capillaries is brought about by the intensity of the congestion, and the escaping blood either finds its way into the tympanum, lifts the mucosa, forming intratympanic bullæ, or lifts the dermal layer of the drum membrane or external auditory canal, forming blood-blebs, which protrude into the external meatus. These bullæ or blebs tend to rupture, leaving behind a raw, unprotected surface prone to infection. The exudation from the mucous surface may be serous or muco-serous and, the lumen of the Eustachian tube being closed by swelling, may collect in considerable quantity in the tympanum. Beyond this the inflammatory process may not go. Or the exudate may be from the first more or less purulent or may become so.

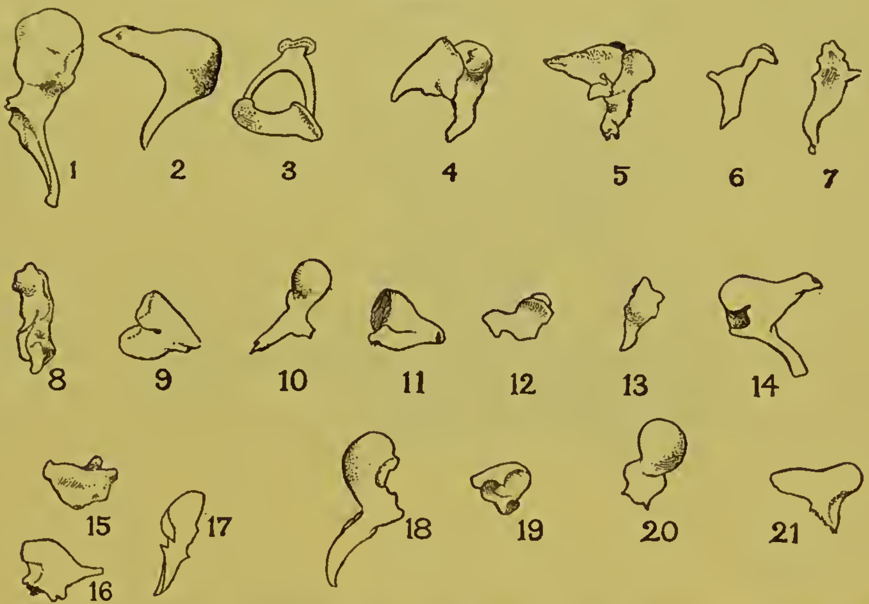
In severe cases, the middle-ear condition may bring about a similar congestion of the labyrinth or of the adjacent portion of the external auditory meatus.

As the swelling and the quantity of intratympanic exudate increases, the drum membrane is put under extreme tension until it becomes so thinned and weakened that it finally gives way, or, because of the intensity of the inflammatory process, a portion of the membrane sloughs, so permitting the escape of the contained secretion. Most commonly this penetration takes place in the lower half of the drum membrane and is accompanied by more or less hemorrhage. Exceptionally the drum membrane may be so strongly built that it is able to resist the pressure arising from the swelling and the accumulated exudation. When this happens, the secretion contained within the middle-ear cavities is forced to seek other outlets, either through the Eustachian tube, the mastoid cortex, the carotid canal, the labyrinth, or, finally, the inner table of the skull. Such a condition of things obtains relatively more frequently in children; the drum membrane here offering greater resistance than the tissues which bind together the still imperfectly united bones.

In the majority of cases of acute purulent inflammation of the middle ear, the process, after perforation, naturally tends toward resolution, with healing of the perforated drum membrane. Less frequently, especially when occurring in the course of the infectious diseases, the process tends to become chronic, generally through the establishment of an area of localized caries at some point in the bony wall or on the ossicles. It is rare, indeed, that a primary attack of purulent otitis media leads directly to serious complications in the way of intracranial disease, and, as Macewen well says, "When such occurs, the invasion is generally so rapid that the intracranial involvement occurs before opportunity is given for radical intervention." The tissues still retain, usually, sufficient vitality to successfully withstand the invasion of infective material.

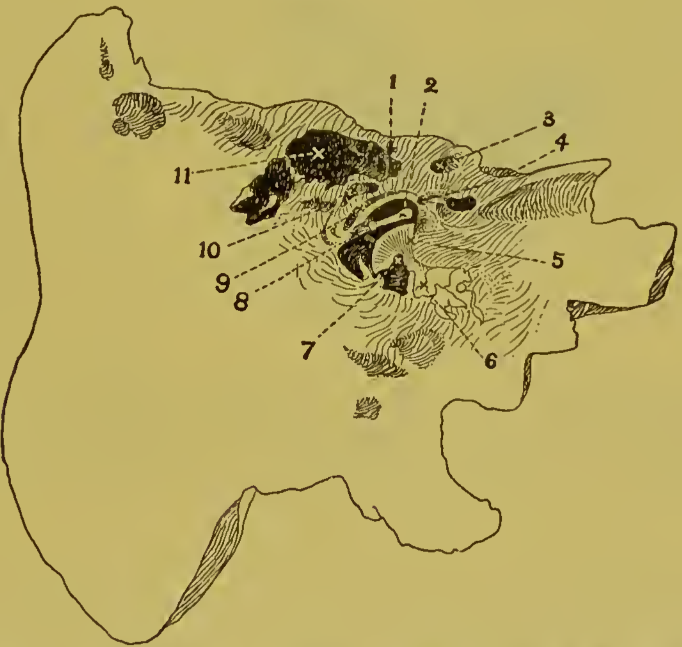
Should the intensity of the inflammatory process be unusually severe or result in a continuance into the chronic stage, then the integrity of various intratympanic structures may be jeopardized. Thus, the small bones, malleus, incus or stapes, may suffer a greater or lesser degree of caries (Fig. 572), or may even have their attach-

FIG. 572.



1, 2, and 3. Normal ossicles, hammer, incus, and stapes. 4 and 5. Carious ankylosed incus and malleus, from two cases of prolonged suppuration. 6 and 7. Portions of neck and handle of malleus, all that was apparently left in these two cases. 8 and 9, 18 and 19, 20 and 21. Carious mallei and incudi grouped as they were removed. 13 and 14. Carious hammer, healthy incus. 10, 11, and 12, 15, 16 and 17. Carious incus and hammer, and in each case a sequestrum from tympanic wall. (From specimens in the author's collection.)

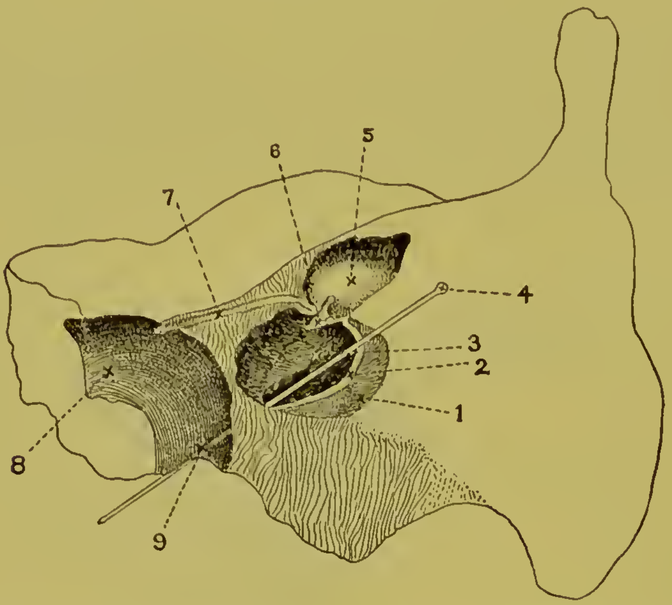
FIG. 573.



View of internal half of middle ear. 1. Aditus. 2. Stapes. 3 and 9. Facial canal. 4. Fossa of oval window. 5. Promontory. 6. Cellular structure of floor of tympanum. 7. Fossa of round window. 8. Stapedius tendon. 10. Horizontal semicircular canal. 11. Antrum.

ments to the neighboring structures destroyed and be carried out of the ear by the purulent discharge or by the solutions used in syringing. Of the ossicles, the incus is the least resistant to pathological change, because of the delicacy of its ligaments and the meagreness of its vascular supply. Occasionally the inflammatory process may invade the Fallopian canal (Fig. 573) and cause more or less injury to the facial nerve, with resulting paralysis. This occurs with special ease in those cases in which there exists a defect in the bone between the canal and the tympanum and is also of more frequent occurrence in children, because of the natural lack of complete ossification of the parts. If the structures of the Eustachian tube are gravely involved, the intensity of the infection may bring about the formation of an abscess in the walls of the tube; or the pus from the tympanum may dissect a way along the tube walls and presently appear as a gravitation abscess in the nasopharynx. It is also possible that the purulent inflammation may extend to the carotid artery through a series of connecting cells lying between the tympanum and the carotid canal (well shown in a specimen in the author's collection—Fig. 574) and opening into both, or through a dehiscence in the bony wall between the carotid canal and the tympanum; should this occur, thrombosis of the carotid artery may result, or fatal hemorrhage ensue, as in Abbe's case. The existence of a similar defect in the bone between the tympanum and the sigmoid sinus or the bulb of the

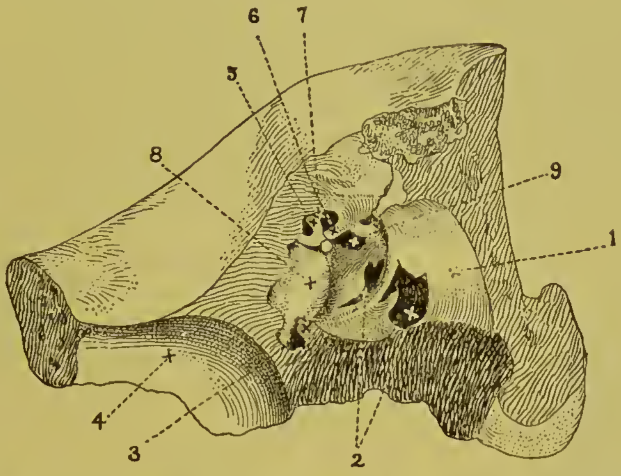
FIG. 574.



Probe passed through chain of cells behind carotid canal and communicating with the tympanic cavity. 1. Exterior auditory meatus, posterior wall. 2. Annulus and remnant of drum membrane. 3. Round window. 4. Probe. 5. Aditus. 6. Stapes. 7. Tensor tympani muscle. 8. Carotid canal. 9. Probe showing through the thin wall of carotid canal.

jugular (Fig. 575) may likewise result in the direct extension of the purulent process to the vein. In rare cases, pus accumulating about the articulation of the lower jaw may ultimately cause erosion of the capsule (Macewen).

FIG. 575.

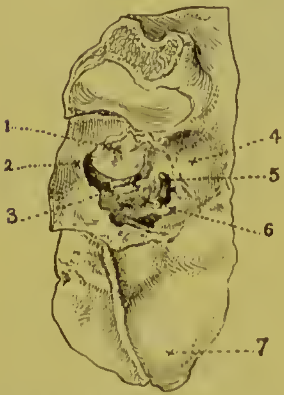


Dehiscences in the bony wall between the tympanic cavity and external auditory canal and the jugular bulb, filled by fibrous tissue. 1. Posterior external canal wall. 2. Dehiscences both sides of annulus. 3. Annulus. 4. Carotid canal. 5. Stapes. 6. Stapedius tendon. 7. Fossa of oval window. 8. Promontory. 9. Cell. (From a specimen in the author's collection.)

Certain changes in the mucous membrane sometimes occur as a result of prolonged suppuration, such as deposits of lime salts, or, where an ulcerative process is going on, with the formation of granulation tissue—usually associated with caries of the underlying bone—the formation of polypi readily follows. In 278 cases of aural polypi observed at the Brooklyn Eye and Ear Hospital, 144 were in males and 134 in females, showing a slight preponderance in favor of males. As to age, about as many were found in patients over as under twenty years of age. We are, therefore, justified in thinking that neither age nor sex has much to do with the formation of polypoid growths, but that it is the condition existing in the middle ear which determines their formation. Much the most frequent form of aural polypi is the mucous, next the fibrous, and, last, the myxoma—of great rarity. These polypi sometimes contain areas either of calcification or ossification. As to the frequency with which polypi occur in cases of chronic middle-ear suppuration, Bacon states that in 234 cases of chronic suppuration, polypi were found in 24. Polypi are not always single, several may coexist in the same ear. Cases in which the tympanic attic is the seat of the disease, with perforation of the membrana flaccida, or Shrapnell's membrane, frequently produce polypoid enlargements.

Presupposing that the inflammatory process is either intense or prolonged, the muco-periosteal protective lining of the middle-ear cavities naturally tends to disintegrate, thus exposing the underlying bone to the same infective attack. This, together with the pressure of the accumulating purulent secretion, brings about caries and necrosis of those parts of the bony cellular structure of least vitality. From the mucous membrane covering the tympanum, the inflammation spreads, by continuity of structure, through the aditus to the mastoid antrum, and from thence into the larger connecting mastoid cells, which also are provided with a mucous membrane. The giving way of these cell walls permits the purulent collection to find its way into the surrounding cells which may have no direct connection with the mastoid antrum, and some of which may be unprovided with a mucous membrane; or the inflammatory process may extend indirectly through the veins or lymphatics into these isolated cells and result in a localized purulent collection which does not communicate with the mastoid antrum; or, without the formation of any marked collections of pus, the intensity of infection may produce a more or less general death of the bony cellular structure, which becomes darkly discolored and friable. Coincidently with the accumulation of pus and death of bone, nature attempts to form a line of demarcation by the proliferation of granulation tissue from the still living tissues. This granulation tissue becoming exuberant, we have cavities in the bone filled with pus, granulation tissue, and the detritus of decayed bone. Sometimes the inflammatory process extends, at the same time, through a series of small cells which occasionally communicate with both the tympanum and the mastoid cells.

Fig. 576.



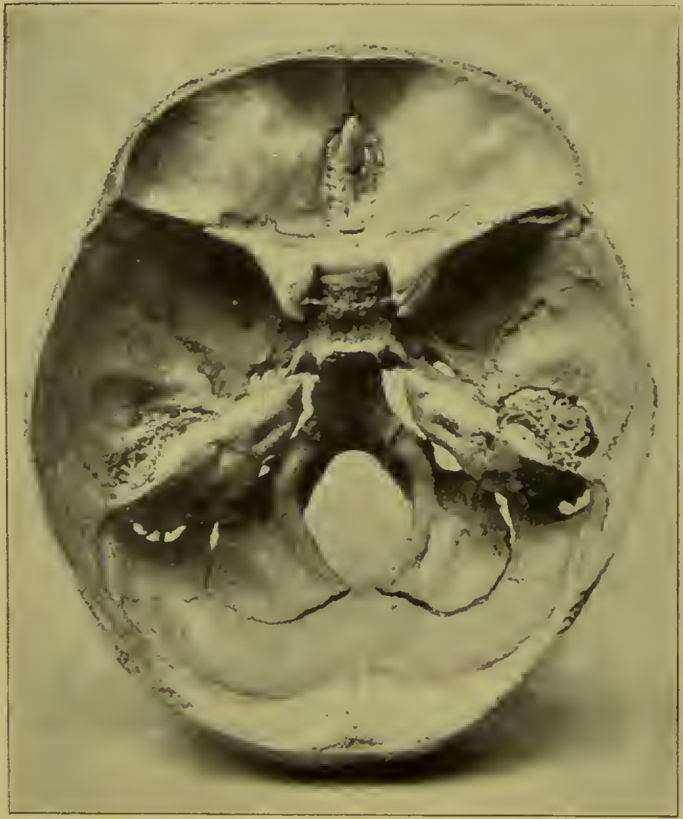
Imperfect development of bony walls of external auditory canal. 1. Tympanic membrane. 2. Anterior wall of canal almost absent. 3. Hiatus in bony wall under annulus. 4. Posterior wall of external canal, with open cells, 6, and an opening into the mastoid cells. 7. Apex of mastoid process. (From a specimen in the author's collection.)

Occasionally the accumulation of pus in the antrum or adjacent cells easily finds its way into the external auditory canal, because the bony wall between is thin, or even at times defective (Fig. 576); or it may pass along a persistent mastosquamosal suture to the soft tissues covering the parts back of the auricle. This suture (Fig. 577) has been found present by Macewen in 67 out of 450 adult temporal bones. Or the pus, having gravitated to the cells in the mastoid tip, or having formed there as a localized collection, may penetrate through the thin inner wall of the tip into the digastric or occipital grooves—a condition first noticed by Bezold, of Munich, and consequently named Bezold's mastoiditis.

In children, the pus contained in the tympanum has a tendency to dissect off the periosteal lining of the posterior and superior external auditory canal walls, forming a channel through which the pus escapes to the soft parts lying behind, above, and even in front of the auricle. But much more frequently, the pus finds its way, in children as in adults,

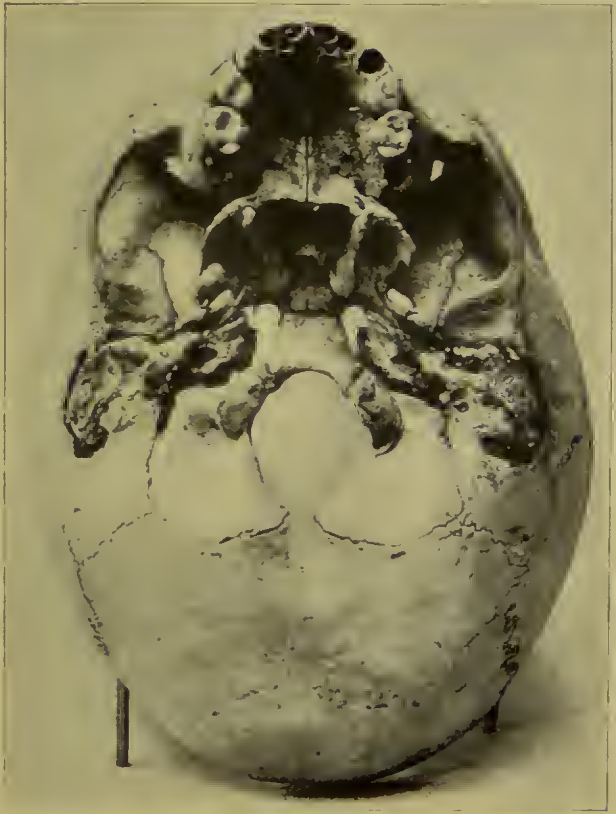
PLATE XXXIV.

FIG. 1.



Interior View of the Base of the Skull of a Six-year-old Child, Showing Bilateral Symmetrical Necrosis of the Temporal Bones.

FIG. 2.

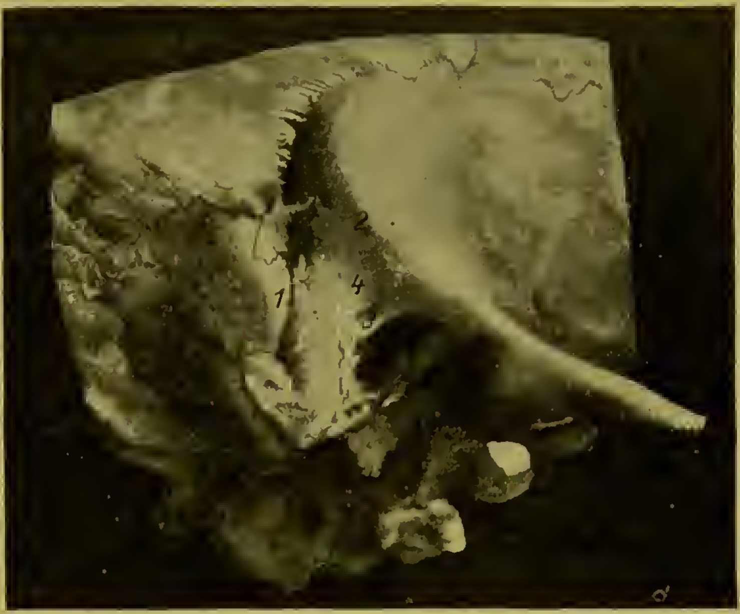


Exterior view of same skull.

[From O. Körner's "Die Eitrigen Erkrankungen des Schläfenbeins."]

first to the mastoid antrum, and thence, by the destruction of the bone, or through the squamomastoid fissure, or by the vessels, to the outside soft parts. Because of the structural peculiarities of the bone in children, they are more liable to have necrosis of considerable portions of the mastoid process, usually in the form of a sequestrum surrounded by pus and granulation tissue.

Fig. 577.

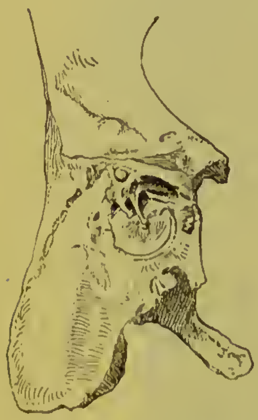


Adult temporal bone with persistent mastosquamosal suture. 1. Persistent mastosquamosal suture. 2. Temporal ridge. 3. Suprameatal spine. 4. Mastoid fossa. (From O. Körner's Die Eitrigen Erkrankungen des Schläfenbeins.)

The direction usually taken by this destruction of the bony parts is toward the mastoid process; but, exceptionally, it may proceed inward and forward, so that, as Macewen says: "The whole of the interior of the petrous bone may become, in extreme cases, hollowed out, leaving a shell externally. The labyrinth, being encased in harder bone, resists the disintegrating process. Such extensive destruction is met with chiefly as a tubercular disintegration. Occasionally both petrous bones are similarly affected." In other cases, it may spread into the diploic cells lying between the superior wall of the external auditory canal and the inner table of the skull forming the floor of the middle cerebral fossa; from these cells it may extend to those present in the posterior root of the zygomatic process; or, from the mastoid process, the destruction may involve the diploic cells in the occipital bone. In fact, wherever there is diploic tissue in the vicinity of the suppurating middle ear there exists the possibility of extension (Plate XXXIV.), especially rapid and widespread if the inflammatory process is tubercular or syphilitic.

Very generally it may happen that the persistent irritation of a chronic purulent inflammation limited to the immediate region of the tympanum induces a condensing osteitis of the neighboring bone, especially that of the mastoid process. This condensation of the bone has been denominated "eburnation," and it is quite a common condition wherever the suppurative process is of a low, tedious type; but it does not by any means necessarily follow: for example, the writer did a radical operation upon a young girl, aged nineteen years, who had been a sufferer from chronic purulent otitis media since an attack of scarlet fever in infancy, and in whom there existed so much atresia of the external auditory canal that the small ear probe of Hartmann was inserted with difficulty, pushing before it a protruding valve-like mass of granulation tissue, yet the mastoid process still retained its original extremely pneumatic formation. Nor does it necessarily follow that the ossicles are carious in cases of chronic middle-ear suppuration; thus, the writer has removed, from a young man who had been a victim of this disease since childhood, the two large ossicles in a perfectly healthy state.

FIG. 578.



Mastoid process of compact tissue, not pathological. Resembles "eburnation." Mastoids vary in texture between this and the pneumatic. (From a specimen in the author's collection.)

Unfortunately, however, this so-called eburnation (Fig. 578) of the bone does not always take place at every point in the surrounding wall; if this were the case an efficient barrier would be raised to protect the intracranial contents. More often a carious process is making inroads at some localized spot that is destined to render abortive all of nature's efforts to guard her citadel.

The carious process advancing upon the bone attacks most frequently the mastoid process; next, the roof of the tympanum or antrum; next, the sigmoid groove, and least frequently the posterior wall of the external auditory canal, or the floor of the tympanic cavity toward the carotid canal, or the jugular fossa, or the petrous portion of the temporal bone.

From the middle-ear cavities the purulent infection spreads to the intracranial structures in various ways. It may pass along a suture to the dura mater; this especially in children, since for obvious reasons the lines of junction of the ossific centres are here very vascular. Again, it may pass through the minute veins which form communications between the middle ear and the superior petrosal and sigmoid sinuses; in chronic inflammation of the middle ear these veins become enlarged and are, therefore, of greater importance. Again, along the nerve sheaths, either along the facial or through the labyrinth to the auditory nerve in the internal auditory meatus. Finally, the infection may spread through the lymphatic vessels inward to the skull contents.

In the majority of cases the pathway of infection is visible because of the discoloration of the bone, its carious condition, or the presence of a fistula. The bone is turned to a dark greenish or blackish color. Macewen believes that "the right side of the head is more often affected by intracranial sequelæ from otitis media than the left."

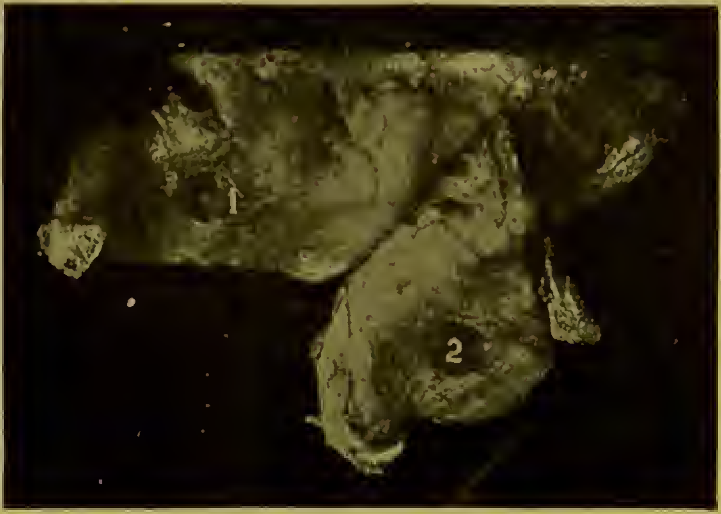
The dura abutting upon the infected bone becomes thickened, hyperæmic, œdematous, and, when exposed by osseous erosion, covered with granulations. If the pus from the middle ear, under pressure, follows the breaking down of the bone, the dura is stripped up and a so-called extradural abscess is formed in the resulting cavity between the dura and the bone. Such extradural abscesses tend to spread upward toward the vertex rather than downward toward the base, because the dura is more loosely attached above. Thus the writer recently had a patient whose mastoid process was intact; but the pus from the middle ear passed through an erosion in the tegmen, dissected off the dura upward to about two inches above the external auditory canal and, at a point one and three-quarter inches above, penetrated through both tables of the skull, appearing externally under the periosteum. (Fig. 602.)

At other times there is produced a localized pachymeningitis, without the loosening of the dura by pus, and this inflammation, spreading to the other membranes of the brain, with the evolution of more or less plastic material, may cement them together around a central core of infection in direct connection with the bone disease. Should an accumulation of pus take place in this central core, between the pia and dura mater, and surrounded and prevented from disseminating by the plastic effusion uniting the brain envelopes, then we have what is commonly called a subdural abscess. In the majority of such cases there occurs coincidently, or directly following, a superficial encephalitis, with or without ulceration.

If the infective material gains an entrance into the subdural space through the dura mater before this adhesion of the membranes has occurred, an acute leptomeningitis, either serous or purulent, will very probably be set up. In the serous variety of leptomeningitis, there is hyperæmia, followed by the exudation of clear serum, often containing flakes of fibrin, leucocytes, or a few pus corpuscles. Such an effusion may result either in internal or external hydrocephalus. Macewen states that occasionally such subdural effusions may be localized. In the purulent variety there is, in addition to the hyperæmia and serum, a marked exudation of leucocytes, degenerating in places into purulent foci, together with more or less encephalitis. Such a leptomeningitis tends to spread rapidly and widely. Infection spreading along the perineural sheaths generally gives rise to leptomeningitis; thus it may pass from the middle to the internal ear and from thence backward along the sheath of the facial and auditory nerves, or from the facial upward and forward through the foramen enclosing the great petrosal nerve. In young children, purulent otitis media is apt to give rise to purulent leptomeningitis, the infection passing through the numerous veins and nerve sheaths; this is especially true of the tubercular affection.

As has been said, more or less encephalitis must necessarily be coincident with or follow close upon a purulent leptomeningitis, because "of the intimate relations" existing between the pia mater and the brain, and "the manner in which the bloodvessels dip into the cerebral substance, carrying along with them their investment of the pia mater." Also, the purulent leptomeningitis, extending along the pia mater where it dips into the sulci, may bring about a collection of pus in these sulci, which may take the form of a localized superficial abscess if the line of invasion is closed by plastic adhesion of the membranes. A localized encephalitis adjacent to this abscess usually results in ulceration of the brain surface, adding to the size and extent of the abscess. Such an abscess, although involving the superficies of the brain, is not entitled to be termed a brain abscess; it is more properly an ulceration.

Fig. 579.



1. Carious opening in tympanic roof. 2. Thickened dura turned back, but when in position covers carious opening. (Bacon.)

A true brain abscess is brought about by the extension of the infection along the bloodvessels into the brain substance proper, inducing œdema of the surrounding brain tissue, with exudation of leucocytes and red blood corpuscles in varying proportions. As the œdema and swelling increase, degeneration of the nerve tissue ensues, and there finally results an area of purulent encephalitis; in other words an abscess made up of pus and disintegrated brain tissue. It sometimes happens that the death or necrosis of a considerable area of cerebral tissue results in the presence of sloughs within the abscess. Such sloughs may be caused by infective embolism or thrombosis of the main vessel supplying a portion of the brain, leading to anæmic gangrene; embolism of the main veins inducing gangrene from the intense pressure set up by the extravasation due to the blocking of the exits of the blood stream, hemorrhagic necrosis; localized pressure of the part engorged, with extravasation exerting influences upon the neighboring brain tissue, leading to its disorganization and death, the intensity of the inflammatory action depending on the nature of the micro-organisms, inducing rapidly advancing necrosis (Macewen). The brain membranes are rarely involved in such a slough. As a rule, there is ocular evidence (Fig. 579) of the pathway taken by the infective material in reaching the purulent collection within the brain; the majority develop by direct extension from the middle ear. But there may be no visible tract, the infection spreading inward through the vascular or lymphatic system.

Tubercular diseases of the middle ear seldom give rise to brain abscess; this is due to the fact that they are more apt to set up a rapidly fatal tubercular leptomeningitis, and the extensive bone destruction permits of free escape of the purulent secretion.

The same micro-organisms have been found in the purulent collections of leptomeningitis and encephalitis as in the otorrhœa.

The brain abscesses caused by purulent otitis media are usually situated in the temporosphenoidal or cerebellar lobes, and are much more frequently consequent upon the chronic than upon the acute process in about the proportion of six to one.

Abscesses of the temporosphenoidal lobe range in size from a few drops to a number of ounces. They are single in 87 per cent. of the cases, according to Macewen. Together with the disintegration and death of the affected brain tissue, the surrounding living tissue begins to throw out material which is eventually transmuted into a fibrinous membrane, at first non-vascular, but later supplied with bloodvessels and of a very low grade of vitality. Thus a capsule is formed, which, when complete, generally brings the suppurative process to a standstill. How long it may take a capsule to form is dependent upon the character of the inflammation. Abscesses three weeks old have been found without capsules. In acute abscesses the surrounding tissue is actively inflamed, with a surface flocculent, shaggy, and irregular, decked here or there with minute sloughs. The escape of blood from the small vessels has been prevented by thrombosis in advance of the molecular disintegration. But it may happen that disintegration is so rapid that thrombosis does not occur, and then bleeding takes place into the abscess cavity. In older abscesses there usually exists a rounded capsule, varying in thickness from one to more than five millimetres, whose internal surface is generally smooth, while the external surface is rather ragged and flocculent. Occasionally the periphery of the capsule is reinforced by a layer of connective tissue, and at times this layer is more or less calcified.

The contents of a cerebral abscess, consisting of pus and disintegrated brain tissue, is usually of a greenish-yellow color. When there has been bleeding into the cavity the color is dark brown. In other cases the contents may be thin, serous, fetid, and contain many minute sloughs. Sometimes the upper part of the abscess cavity may contain more or less fetid gas.

It has happened that another abscess may form outside of an encapsulated abscess, because the compression and consequent irritation of the original one had induced a purulent encephalitis, the encapsulated abscess remaining intact. Again, the inner surface of the capsule may begin to granulate with the production of more pus and the enlargement of the original abscess.

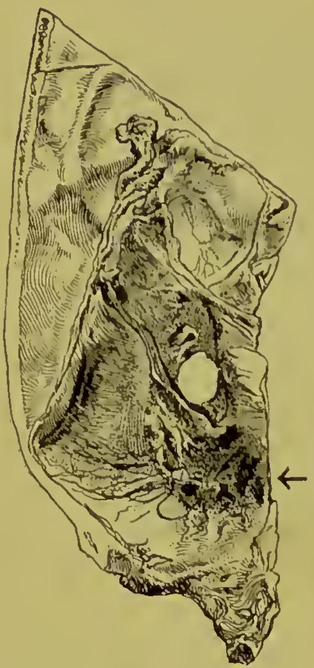
It is possible for a cerebral abscess to be absorbed. The fluid portion of the pus may become absorbed, and newly formed vessels originating from the living brain tissue and penetrating the capsule may bring about the absorption of the purulent débris through phagocytic action.

Brain abscesses have discharged by erosion through the tegmen tympani or antri, through the external wall of the skull, and through the internal wall of the mastoid cells. But it rarely happens that a cure is brought about in this way.

Usually the abscess breaks through the surface of the brain, setting up an acute leptomeningitis, or into the ventricles.

The infective process, originating in the middle ear, sometimes picks out a course toward the sigmoid groove, and when it happens that the osseous wall is deficient at any point, being replaced by fibrous membrane only, the infection may quickly extend to the contained sinus. More usually, caries of the bony wall results in erosion, with ultimate exposure of the sinus. (Fig. 580.) Less frequently, as there are veins from the tympanum emptying into the sigmoid and petrosal sinuses, a vein may become thrombosed and the thrombus extend into the sinuses; this generally produces thrombosis of the sigmoid sinus first, extending thence into the other sinuses, but occasionally the petrosal sinuses are first affected, and the sigmoid is implicated later as a result. However, very few cases of sigmoid sinus thrombosis occur without extensive disease of the bone. This is especially true in tubercular affections and in carcinoma auris. As the right sigmoid groove is generally wider and deeper and is projected more outward and forward than the left, it is but natural that it should be somewhat more frequently affected.

FIG. 580.



Part of skull of young girl who died of infective sinus thrombosis. Shows internal dural wall of sinus reflected back, exposing perforation in wall of sigmoid groove; also the dark, discolored appearance of sinus wall curving to the edge of the bone. Arrow points to sinus. (From a specimen in the author's collection.)

Infective thrombosis of the sigmoid sinus occurs chiefly in adults, exceptionally in children, and rarely in the aged. It is often associated in its later stages with meningitis, and not infrequently with cerebral or cerebellar abscess.

As happens in all cases of venous thrombosis, the internal endothelial lining of the sinus becomes roughened through swelling, softening, disintegration and desquamation of the cells, and the fibrinous constituents of the blood current find a lodgement on the roughened surface; the mass so formed gradually encroaches upon the lumen of the vessel until it is partially or wholly occluded. When the sinus is wholly occluded, the clot spreads for a greater or lesser distance above and below, and so effectually stops the flow of blood through the sinus. At this point the clot may become organized, the virulence of the infection having exhausted itself naturally or because of operative interference with the affected bone, or the clot may begin to disintegrate with more or less formation of pus. This disintegration results in a purulent fluid, greenish brown, grumous, and often streaked with pus, collecting around the original site of infection for the sinus, and beyond this in both directions, upward and downward, there usually extends a healthy clot. In some cases, sloughing of the external wall of the sinus occurs, with evacuation of the fluid contents into the mastoid process; the extension of the obstructing clot within the healthy portion of the sinus preventing any hemorrhage,

FIG. 581.

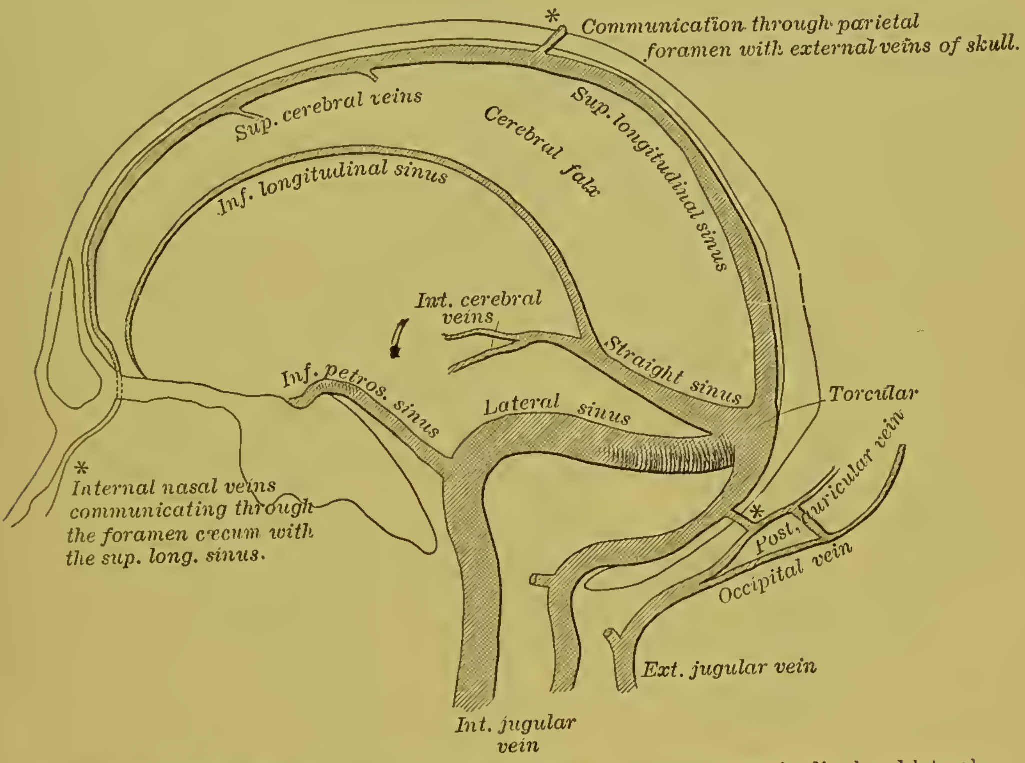


Diagram showing the communications existing between the superior longitudinal and lateral sinuses and the external veins, indicated in the figure by *. (LEUBE.)

as a rule. Should the visceral layer of the sinus become affected, an acute leptomeningitis, which may be localized, usually results. The bone and the soft tissues, in the immediate neighborhood of the disintegrating process within the sinus, get to be dark greenish or brownish in color, and the surface of the bone becomes roughened or eroded. Finally, softening of these tissues takes place, if the patient lives so long.

FIG. 582.

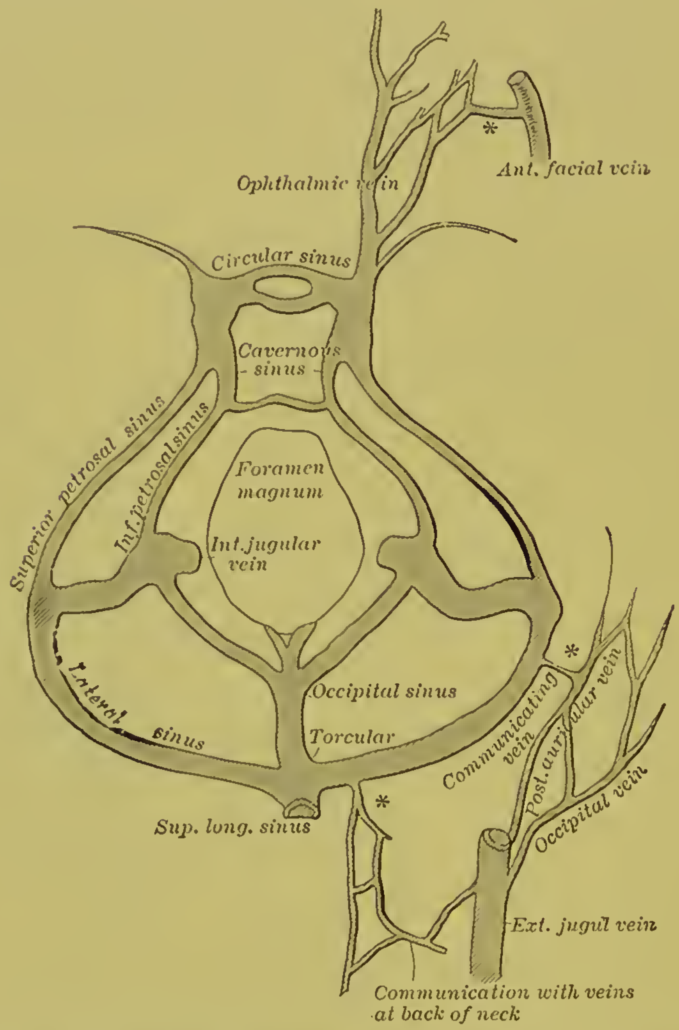


Diagram showing the communications existing between the lateral and cavernous sinuses and the external veins, indicated in the figure by *. (LEUBE.)

The infective sinus phlebitis may extend downward into the internal jugular vein, and even into the superior vena cava. The soft tissues surrounding the affected veins may become œdematous and infiltrated with plastic material, and the cervical lymphatics involved form a continuous line of swelling down the neck under the deep cervical fascia. The swollen mass may undergo purulent disintegration, forming an abscess in the neck, sometimes directly connected with the disintegrating thrombus within the vein. Even here, however, there exists often centrally a firm thrombus which for a time prevents further dissemination of the infective material.

Infective material may be carried into the general circulation by way of the internal jugular vein or by way of the posterior condyloid vein, the occipital sinus, or the mastoid vein, which communicates indirectly with the subclavian and innominate veins without passing through the internal jugular. (Figs. 581 and 582.) Whiting states that "there is great likelihood that general infection may also take place by lymphatic absorption of the pyogenic organisms." Macewen says, "Infective matter may spread through the sinus walls into the neighboring parts, where it may be taken up by the congested vessels and perivascular spaces and carried into the circulation."

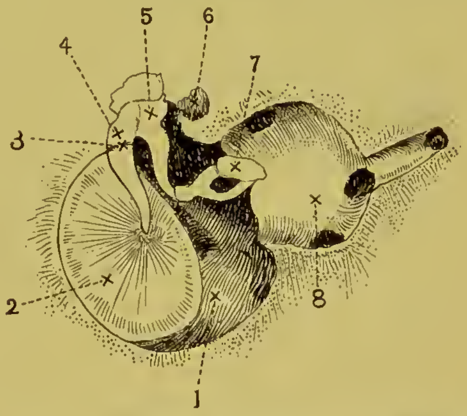
Within the skull the dura may be stripped up from the bone by purulent exudation or by the evacuation of the purulent contents of the sinus, and the pus may seek an exit externally by way of the mastoid foramen or through the posterior condylar foramen, where it forms an abscess under the deep fascia in the upper third of the posterior cervical triangle. When the pus forms on the visceral side of the sigmoid sinus, it may gain an exit through the anterior condyloid foramen.

Occasionally the cerebellar veins become thrombosed, thus admitting pathogenic organisms into the cerebellum. From the sigmoid sinus, the disease may take its way to the cavernous sinus, from whence it may extend along the ophthalmic vein into the orbit, inducing a purulent cellulitis. (See Fig. 582.)

Septic material once in the circulation is carried along until deposited in the lungs, brain, intestines, or muscular structures; least often in the kidneys or liver. Wherever the septic particles finally lodge there results a metastatic abscess.

There exist two tracts by which the infective process extends from the middle ear to the cerebellum. First through the labyrinth (Fig. 583) with the neighboring portion of the mastoid antrum; and second, through the sigmoid groove and sinus. The first usually leads to abscess in the median portion, while the second leads to abscess in the lateral portion of the cerebellum.

Fig. 583.



View of middle and internal ear from in front. 1. Floor of tympanum. 2. Membrana vibrans. 3. Chorda tympani nerve. 4. Handle of hammer. 5. Incus. 6. Fallopian canal. 7. Stapes. 8. Vestibule of labyrinth, with openings of semicircular canals. (From a specimen in the author's collection.)

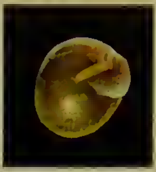
There has been no record of a cerebellar abscess forming in less time than from two to five weeks. These abscesses are usually small, although they may grow so large as to have a capacity of four ounces. Only one case has occurred before the fourth year. They are very rare in the first ten years of life and after thirty, and are most frequent between the ages of ten and thirty years. The oldest patient was fifty-five years old—a female. Koch (Alderton's translation) believes otic abscesses are nearly as frequent in the cerebellum as in the cerebrum. Koch also states that cerebellar abscesses occur twice as frequently in males as in females. There is a slight preference for the right hemisphere—fifty-three in the right to forty-eight in the left. They are usually situated close under the cortex, the cortex itself usually offering an appreciable resistance. In a series of 44 cases, a capsule was present in 26 and absent in 18. Multiple abscesses were found in 16 out of 78 fatal cases, 6 were multiple abscesses in the same hemisphere, 2 had one in each hemisphere, 1 had set up metastatic abscesses, and 7 had another abscess either in the temporal or occipital lobes. As with the other intracranial sequelæ of purulent otitis media, cerebellar abscess usually follows upon the chronic form; in only 15 out of 100 cases did it succeed to the acute form.

The sigmoid sulcus is the usual place of communication, and the majority are in direct contact with the sigmoid sinus, which is often thrombosed. In 63 out of 76 cases of chronic otorrhœa with cerebellar abscess there were present on the anterior wall of the posterior cranial fossa marked and important changes. The area of attack of the carious process extends from the superior to the inferior border of the posterior surface of the pyramid, and from the posterior edge of the sigmoid groove to the anterior edge of the internal auditory meatus, occasionally involving the tip of the pyramid. The caries is not in the sigmoid groove in the majority of cases, but anterior to it. Koch says that the situation, position, and form of the sigmoid groove has little to do with the genesis of cerebellar abscess. The whole development of the cerebellar abscess is inward into the medullary substance. Cortex abscesses are much rarer than in the temporal lobe, although the cortex may become so thinned as to disappear, and the dura or tentorium come to form a wall of the abscess.

Cerebellar abscesses seldom contain such pieces of necrotic brain tissue as do temporal abscesses. The contained pus is usually of a creamy consistency, of a yellowish or greenish color, frequently fetid, but free from gas bubbles. Blood clots have been seldom found. The neighborhood of the abscess is usually microscopically intact. Sometimes there is a surrounding zone of red or white softening, in which may exist small hemorrhages and small abscesses.

In several instances the cerebellar abscess and its accompanying meningitis have produced a state of internal hydrocephalus. If rupture occurs, the pus may enter the arachnoid space, setting up a purulent leptomeningitis, or, a cementing of the meninges previously occurring, the pus may form a subdural abscess by spreading between the dura and the brain, especially under the tentorium; or, and this is

PLATE XXXV.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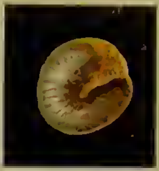
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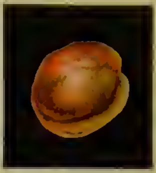
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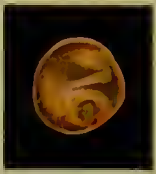
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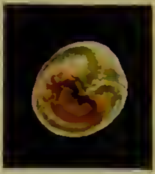
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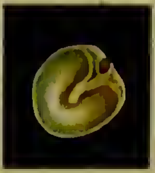
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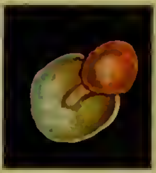
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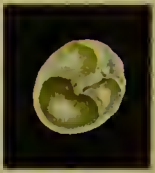
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FIG. 1. CHRONIC SEROUS CATARRH OF THE MIDDLE EAR. Retraction of the Tympanic Membrane, with Collection of Serous Exudate within the Tympanum; Curved Fluid Line in Front of the Umbo.

FIG. 2. ACUTE CATARRHAL OTITIS MEDIA. Injection of the Radiating Capillaries and the Malleal Plexus.

FIG. 3. ACUTE SUPPURATIVE OTITIS MEDIA. Marked Bulging of the Posterior-superior Quadrant, Hiding Handle of Hammer; Ecchymoses in the Engorged Tympanic Membrane.

FIG. 4. ACUTE SUPPURATIVE OTITIS MEDIA. Tympanic Membrane Congested; only the Short Process and Upper Part of the Manubrium is Visible; a Small Perforation in the Anterior-inferior Quadrant, through which could be seen a Pulsating Light Reflex.

FIG. 5. CHRONIC SUPPURATIVE OTITIS MEDIA (during an exacerbation). Kidney-shaped Perforation with Granulating Edge; Mucous Membrane of Tympanum Congested.

FIG. 6. CHRONIC SUPPURATIVE OTITIS MEDIA. Perforation in Shrapnell's Membrane; Incus Carious.

FIG. 7. CHRONIC SUPPURATIVE OTITIS MEDIA. Perforation of Shrapnell's Membrane, through which Protrudes a Polypoid Granulation; Caries of the Walls of the Attic.

FIG. 8. THE RESULT FOLLOWING HEALING OF A CHRONIC SUPPURATIVE OTITIS MEDIA. Chalk Deposits in Front and Behind Manubrium; Kidney-shaped Cicatrix Occupying Inferior Half of Tympanic Membrane.

[From Brühl's Atlas der Ohrenheilkunde.]

frequent, a fistula forms through the dura to the petrous bone. Exceptionally the abscess may break into the fourth ventricle.

Only one case of spontaneous healing of an otic cerebellar abscess has been noted, the healing resulting in the formation of a thick cicatrix.

Otitis Media Purulenta Acuta. This form of otitis media is a continuation of the process described under the heading of serous exudation, much intensified because of the greater virulence of the infection.

Symptoms. In the beginning the same symptoms make their appearance: hardness of hearing, a feeling of fulness or stuffiness, and tinnitus, which is much more marked. The tinnitus is of a hissing, roaring, pulsating, or throbbing character. Pain is quickly in evidence; it is usually intense, radiating over the affected side of the head, and seems to be worse at night. There is a sense of heat around and in the ear, together with a feeling of numbness. If there is great intratympanic pressure the patient complains of dizziness and vertigo. The bodily temperature rises sometimes to 101° to 103° F., and occasionally there is delirium. Sometimes there is impairment of the senses of taste and smell. In children the condition sometimes simulates an attack of meningitis, the temperature rising at times to 105° F., with great restlessness and screaming. In them the attack sometimes begins with a convulsion or vomiting. In infants the hand is frequently applied to the affected ear. Some patients refer the pain to the teeth; unless the attendant is acquainted with this fact an error in diagnosis is possible. Those patients who have a defect in the bony wall of the Fallopian canal may experience muscular twitchings due to irritation of the facial nerve; rarely facial palsy may appear, due to the same condition.

In the tubercular form of the affection the process is very insidious, often painless, and sometimes exists without perforation of the drum membrane. In these cases the lymphatic glands around the auricle are frequently enlarged. Caries and necrosis of the ossicles are apt to occur.

Objectively, there is noted congestion of the drum membrane beginning in Shrapnell's membrane, along the posterior of the hammer handle, in the periphery at the attachment of the membrane to the annulus tympanicus, and in the capillary twigs radiating from the periphery toward the umbo, the rest of the membrane being dull gray and lustreless. (Plate XXXV., Fig. 2.) Soon this congestion spreads over the whole surface until the drumhead becomes pink, or red, or crimson. If the infection is very intense, for instance, in cases caused by the grippe or sea-bathing, the capillary twigs may rupture and the hemorrhage raise the dermal layer until quite large blood-blebs appear on the outer suface of the drumhead and neighboring parts of the canal wall, which is also congested. The congestion is usually much less marked in tuberculous cases. Serous or purulent exudation may take place within the texture of the drum membrane, forming serous cysts or localized abscesses, or the life of the dermal layer may be destroyed so that it finally exfoliates. Before exfoliation takes place the appearance of the drum membrane is apt to be deceptive; one might think that the dull leaden looking drumhead concealed no active inflammatory process within the tympanum; but the use of cotton on a cotton-carrier gently rubbed over the surface removes the exfoliating dermal layer, leaving behind a smooth red surface which may be mistaken for a polypus. As the congestion increases the landmarks normally present on the drum membrane are obscured and finally become invisible; thus, the light reflex, the hammer handle, and often the anterior and posterior folds, are gradually lost to view.

The increasing quantity of fluid in the tympanum begins to exert pressure on the tympanic membrane, which begins to bulge outwardly (Plate XXXV., Fig. 3), most frequently in the posterior half, but sometimes at the site of Shrapnell's membrane, or both of these sections may be involved. Exceptionally, bulging may not appear, although exudation exists. The lymphatic glands behind the auricle and over the Eustachian tube may be enlarged and tender, especially in children, and in severe cases there may be an area of tenderness over the mastoid antrum.

Shortly, unless the condition is relieved, perforation of the drumhead takes place in anywhere from a few hours to a number of days. Immediately following perforation a discharge makes its appearance; at first serous or serosanguinolent, it soon becomes purulent or mucopurulent, except in cases of tuberculosis, when it is apt to remain thin and watery. The perforation is most usually situated in the inferior half of the tympanic membrane; exceptionally in Shrapnell's membrane, if the inflammatory process is most intense in the attic. (Fig. 569.) The perforation is generally round, unless there has been marked necrosis of tissue, such as occurs with alarming rapidity in scarlatinal otitis. In children the drum is naturally thicker than in adults and the Eustachian tube is wider, permitting the escape of fluid, for both of which reasons perforation may fail to take place or occur much later than in adults. Even in adults a well-marked purulent inflammation may exist in the middle ear without any perforation of the tympanic membrane.

Generally, after perforation, considerable relief from the subjective symptoms, especially pain, is experienced. As the discharge continues, the skin of the external auditory canal may become congested and swollen and, in children, an eczematous dermatitis extending to the auricle may be set up.

Acute purulent otitis media seldom leads to intracranial complications. Erysipelas, usually beginning in the auricle, has been noted as a complication, and may extend to the scalp and face, occasioning considerable constitutional disturbance. In children a secondary otitis externa may arise, which later may extend to the mastoid periosteum, forming a subperiosteal mastoid abscess. The most frequent complication is that of mastoiditis.

The inflammatory process, if intelligently treated, tends to resolution in from a few days to as many weeks, usually with the return of good functional ability. The perforation heals with or without the formation of a cicatrix. In some cases the membrane is left permanently thickened or in parts calcified, from interstitial myringitis, and occasionally adhesions form in the tympanum. Should these changes occur, the hearing may be considerably impaired.

The **prognosis** is unfavorable in patients suffering from cachexia, whether scrofulous, tuberculous, or syphilitic; when the disease occurs in the course of severe attacks of influenza, diphtheria, or the exanthemata; and when the inflammation is mainly confined to the attic, with perforation of Shrapnell's membrane.

The **diagnosis** is indicated by the presence and course of the symptoms as detailed. The presence of a pulsating light reflex on the surface of fluid at the fundus of the canal is usually taken as presumptive evidence of the existence of a perforation (Plate XXXV., Fig. 4); but it may be due to the great vascular tension within the tympanum transmitted through the drum membrane. If stringy mucus is found in the discharge it must certainly have come from the tympanum through a perforation. Inflation of the middle ear may cause a blowing, bubbling, or hissing whistle when a perforation exists, unless that perforation is situated in Shrapnell's membrane, or in a portion of the membrane covering a part of the tympanum shut off from the Eustachian tube by adhesions. Suction, exerted by means of Siegle's otoscope, or inflations of the middle ear, may show the presence of a perforation by the appearance of discharge in a canal which has previously been thoroughly dried.

Barr well says that "obscure illness in young children, consisting of feverishness, irritability, and symptoms of cerebral disturbance, are sometimes explained by the ultimate appearance of a discharge from the ear." Occurring in the course of infectious diseases, its appearance is usually marked by a sudden accession of temperature.

In the tuberculous form the perforation tends to enlarge by the melting away of its edges, the tissues are pale, and granulations are rarely present. My colleague, Dr. Burnett C. Collins, found only 4 cases in which the middle ear was involved in 62 patients with well-marked tuberculosis. This is about the proportion usually reported.

The **treatment** of acute suppuration of the middle ear may be divided into that appropriate to the condition before perforation and that after. While there are many methods of treatment in vogue among aurists in general, most of which are of value in appropriate cases, the writer believes that the object of this article will best be met by confining his description to those methods which he habitually uses in his own private and hospital practice and which have stood the test of his experience. He does not believe in the use of the various anodyne instillations or suppositories sometimes recommended for use in the external auditory canal. The patient should be put upon a light but nutritious diet, alcohol and tobacco and coffee should be denied and, if possible, rest at home should be enjoined. A mild cholagogue laxative should be administered at the very beginning, and when narcotics are given for pain the constipating tendency should be overcome by the simultaneous exhibition of a laxative.

When there is marked fever, aconite in small and repeated doses is of great value, preferably the tincture in minim or half-minim doses hourly. There is rarely any time to correct errors in the general health. The inflammatory condition existing in the nasopharyngeal cavities should receive the indicated treatment. Very gentle politzerization is sometimes of great benefit in the very earliest stage, before there is much exudation and bulging; afterward it often does harm by increasing tension and driving the infected exudate into the furthest recesses of the middle-ear cavities. Politzerization should only be used after a thorough and painstaking cleansing of the nasopharynx.

Local bloodletting, by means of Bacon's artificial leech (Figs. 559 and 560) or by the live Swedish leech, is frequently of great value, but should only be used in sturdy, plethoric patients, never in those who are weak or anæmic. They are to be applied either immediately in front or behind the auricle, as close to it as possible, and from two to four of the natural leeches must be used to obtain much of an effect. Afterward, if it is desirable to encourage hemorrhage, the bleeding may be prolonged by the use of lukewarm water. The bleeding is usually well controlled by pressure; but occasionally styptics have to be used. Needless to say, the skin before application and the wounds afterward should be rendered aseptic.

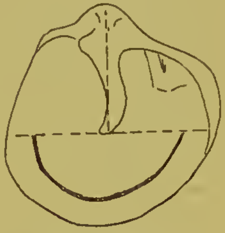
From the beginning heat should be applied to the ear, either by means of the hot-water bag, the hot-water douche, or both. A mild antiseptic may be added to the douche. The writer believes the thorough drying out of the external auditory canal, after each douching, to be of the utmost importance if the skin of the external ear is to be maintained in a healthy state. This drying should be done by means of cotton pledgets formed on a cotton-carrier, then removed from the carrier and gently introduced into the ear canal. The douching is to be repeated every two hours, and between times the hot-water bag should be applied frequently. In the intervals a soft wad of cotton should be placed in the concha to protect from draughts. At night the patient should sleep with the head high, on two or three pillows.

The writer would heartily indorse the remarks of Duel, which are as follows: "In diphtheria and the exanthemata the only way to be sure that an acute otitis is not developing is by daily inspection of the tympanic membrane. Inasmuch as this is impracticable, it would seem wise to have the canal sterilized daily by irrigations with 1:1000 bichloride solutions in order to avoid infection in those cases where spontaneous rupture occurs without warning symptoms." Every medical attendant on a severe case of these diseases should feel a moral obligation to have a competent aurist periodically examine his patient's ears, at least as frequently as once a week, since the field of prophylaxis here is as broad as that of treatment. Many a child consigned to the despair of a postscarlatinal or postdiphtheritic chronic otitis has good grounds for condemning the criminal negligence of his family physician.

Incision of the tympanic membrane under the most careful antiseptic precautions, including thorough treatment of the external ear canal, is always indicated in the case of intense pain unrelieved by treatment. Also, in the writer's opinion, whenever there is bulging, however slight, if accompanied by pain. It is undoubtedly true that in the majority of cases we wait too long. Early incision ensures an aseptic field and a probably lessened intensity of infection; this is especially true in influenza, diphtheria, and the exanthemata. Early incision has the added value of ensuring against tissue necrosis and of being at the point of election for the most efficient drainage.

The operation of incising the drum membrane is preferably begun, under the use of nitrous oxide anæsthesia, near the posterior border, on a level with the umbo, and carried around parallel to the inferior border until a point is reached anteriorly at the end of a line drawn through the point of beginning and the umbo; in other words, the whole inferior half of the drum membrane is turned into a flap. (Fig. 584.) The knife should be a straight or curved bistoury, and should be carried through the membrane only, not so deeply as to score the inner tympanic wall. If there is bulging, the cut is to be so modified as to include the most dependent part of the bulge. An entirely different form of incision is indicated when the attic is involved, with bulging of Shrapnell's membrane. Here the writer believes in carrying a bistoury from just above the short process of the hammer upward and inward, to divide any folds of mucous membrane until the bony edge of the superior canal wall is reached, whence the incision is continued along the junction of the posterior and superior canal wall to and including the part overlying the mastoid antrum. Spontaneous rupture does not always provide for drainage efficiently; in which case the perforation should always be enlarged along the lines above indicated.

FIG. 584.

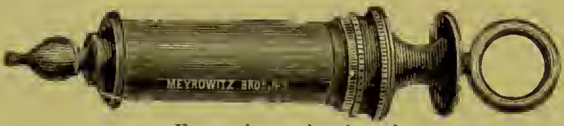


Line of incision on tympanic membrane.

Following early incision, and only when done under the strictest antiseptic precautions, the writer habitually introduces a slender gauze wick up to the fundus of the canal, being careful not to pack it into the canal, then loosely packs gauze into the concha, and covers the dressing with a layer of absorbent or raw cotton, held in place by a strip of zinc oxide plaster attached to the auricle. This dressing should be renewed at intervals of twelve hours for the first few dressings, the discharge being removed each time by aseptic cotton pledgets, and often the ear is found to be healed after a few treatments. If the gauze wick is saturated at each dressing and the irritation in the middle ear and canal increases, this form of treatment must be discontinued in favor of syringing. Some cases do well simply by drying-out the canal at frequent intervals—every three hours—by means of pledgets of absorbent cotton, without syringing.

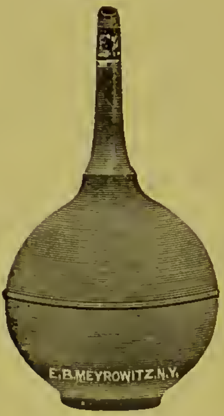
The ear failing to do well under the above methods, then resort must be had to syringing. As the main object of syringing is to remove the discharges, this is best accomplished at home by the use of the hand syringe, either a Davidson or a Goodyear one-ounce hard-rubber ear syringe (Fig. 585) or a Davidson aural and ulcer soft-rubber bulb syringe. (Fig. 586.) The douche in the patient's hand rarely meets the indications at this stage. A pint of hot water should be used at one sitting, and the sittings should be at intervals of two or three hours. The auricle should be held out from the side of the head and the nozzle of the syringe introduced to just within the external orifice of the canal. Any of the antiseptics in ordinary use, boric acid, bichloride of mercury, or carbolic acid may be added to the water, which should always be boiled before use. No effervescent remedy, such as peroxide of hydrogen, should be employed in acute cases, for obvious reasons. The writer prefers the bichloride of mercury solution, when he does not use ordinary sterile water, in strengths of from 1 : 3000 to 1 : 5000. The syringe between treatments should be placed in a solution of carbolic acid or bichloride of mercury, having previously been filled from the solution. Always after syringing, the ear canal should be gently but thoroughly dried out by means of pledgets of aseptic absorbent cotton, and a soft wad of cotton should be placed in the concha. The injected fluid sometimes enters the middle ear, the Eustachian tube, and the throat, in which case care should be taken to use only the milder antiseptics.

FIG. 585.



Ear syringe; hard rubber.

FIG. 586.



Bulb syringe.

The writer does not believe in the use of powders in acute cases; they blur the picture and are prone to lead to retention.

Some politzerization, at intervals of one to three days after free incision, is generally very beneficial.

After the subsidence of the inflammatory process and the healing of the perforation, the ear should be inflated gently from time to time and a soft cotton wad worn in the concha. Precautions should be taken against those things likely to cause recurrence of the trouble, such as exposure to cold or bathing the head.

Otitis Media Purulenta Chronica. When the acute process persists for a period longer than five or six weeks it is usually considered to have entered into the chronic phase.

Hardness of hearing, of varying degree, is usually present; but it is by no means invariable. The hardness of hearing is due to presence of secretion, to swelling of the soft parts, to existence of newly formed fibrous tissue in the shape of adhesions or bands, to rigidity of the ossicular articulations, to presence of granulations or polypoid growths, or to accumulation of cholesteatomatous masses. The existence of a perforation has little to do with the loss of hearing. Painful sensations are not usually present unless there is retention of purulent products or an infection of the structures of the external ear canal. Sometimes there is complaint of more or less dull headache, especially by weak and anæmic patients. Noises in the ear or head are not prominent, as a rule, and are often absent. Dizziness or vertigo at varying intervals is an element in certain cases.

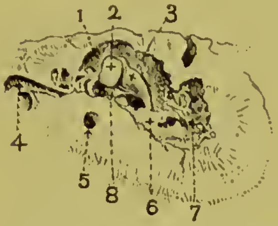
Objectively, enlargement and tenderness of the lymphatic glands in the neighborhood of the ear is often noticed, particularly in children; if the infection is severe, even the deep cervical lymphatic glands may be involved. The skin of the auricle and canal may be the seat of a dermatitis or an eczematous inflammation, and, in children, a pustular eczema may spread to the side of the face, due to the irritating qualities of the discharge. The discharge varies in character from thin serous or serosanguinolent to purulent or bloody; often fetid if the parts are not kept scrupulously clean. Especially in children these discharges may enter the pharynx through the Eustachian tube and bring about a general toxæmia. The drum membrane is perforated, thickened, or calcareous in parts, and of a grayish or pinkish color. The perforation is usually single; rarely, a number may coexist in the same membrane. The perforations (Plate XXXV., Fig. 5) are round, ovoid, or kidney-shaped and may have granulating edges. Sometimes the edges are adherent in places to the inner tympanic wall. When the perforation is in Shrapnell's membrane the outline may be irregular from erosion of the bony margin, the *pars epitympanica.* Perforations are usually situated in the lower or posterior halves of the membrane. The drum membrane is probably never entirely destroyed. Through the perforation may be seen the intratympanic structures existing opposite its location, more or less modified by the inflammatory process. The mucous membrane lining of the tympanum may be thickened, or granular, or ulcerated; it is usually red in color from congestion. In very old or sluggish cases the mucous membrane may be grayish or yellowish in color. There is often present carious degeneration of portions of the bony walls of the tympanum or of the ossicles. Granulations and polypi (Plate XXXV., Fig. 6) are frequently seen protruding through the perforation, especially when the attic is involved and the perforation is in Shrapnell's membrane. Very rarely these granulations may be an outgrowth from the dura exposed by osseous erosion.

The **diagnosis** is made by the history and the presence of the above symptoms, subjective and objective. The element of tuberculosis is indicated by a gradual melting away of the tissues of the drum membrane and tympanum, the constitutional condition of the patient, and the presence of the tubercle bacillus in the discharge.

The **prognosis** depends to a considerable extent upon the state of health of the patient, there being always less chance of a cure in those afflicted by the tubercular, scrofulous, or syphilitic diathesis. So long as the process persists there is always danger to life from intracranial complications. The business, habits, and position in life of the patient exert more or less influence; the more favorable these are, the better the chance of recovery. Certain conditions obtaining in the affected parts adversely influence the progress toward healing; thus, the presence of granulations or polypi indicating a deep-seated affection, atresia of the external auditory canal, retained and decomposing purulent or cholesteatomatous material, and caries or necrosis of the osseous walls or ossicles. The lack of intelligent home treatment very greatly militates against a favorable prognosis, as does also failure with long-continued treatment.

The prognosis as to the maintenance of hearing depends upon the amount of interference with the vibrating power of the sound-conducting apparatus. As none of the middle-ear structures except the membranes of the round and oval windows, together with the footplate of the stapes, is absolutely essential to function, we hence quite frequently see patients who hear well, notwithstanding the loss of the drum membrane and larger ossicles. Such obstacles to hearing as inspissated secretion, polypi, and the presence of fibrous bands and adhesions are always susceptible to removal, with improvement of function.

Fig. 587.



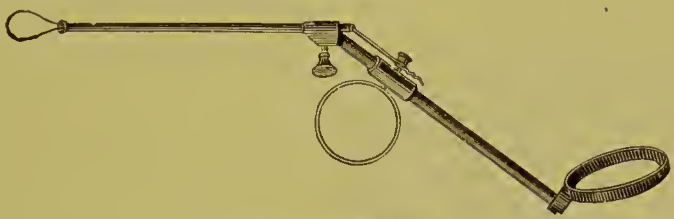
View of tympanic attic from above. 1. External wall of attic or pars epitympanica. 2. Hammer head. 3. Incus. 4. Fallopian canal for facial nerve. 5. Vertical semicircular canal. 6. Horizontal semicircular canal. 7. Antrum. 8. Incudo-stapedial joint. Folds of membrane nearly shut off the attic from the atrium. (From a specimen in the author's collection.)

When healing of the middle-ear inflammation takes place with a persistence of the perforation, the edges cicatrizing, the so-called "dry perforation" results, and the patient is more exposed to a recurrence than when the perforation is closed by cicatricial tissue. Closure of the perforation sometimes lessens the hearing ability. It is not impossible sometimes to bring about the cicatrization of very old perforations, even when of considerable size.

There are certain sequelæ which may result from a chronic purulent inflammation of the middle ear. Thus may be mentioned aural polypi, periostitis of the mastoid process, mastoid abscess, cholesteatomatous tumors within the mastoid process, facial paralysis, labyrinthitis (especially in syphilitic subjects), and the various intracranial infective lesions. The semicircular canals (Fig. 587) are sometimes, although rarely, affected, disturbances of equilibrium and giddiness being produced. A facial paralysis arising from middle-ear disease is a lesion of the nerve and is usually much more complete than when the cause is in the central nervous system; in the latter the patient can generally close the eyelids, and the face is not so expressionless.

The appearance of the drum membrane after healing varies greatly. It may be thickened and opaque, may contain calcareous plaques (Plate XXXV., Fig. 7), may be adherent in places to the inner structures, may present cicatrices (Plate XXXV., Fig. 7) which are darker in color, with well-defined edges, may be atrophied in spots, or, finally, may present one or more "dry perforations."

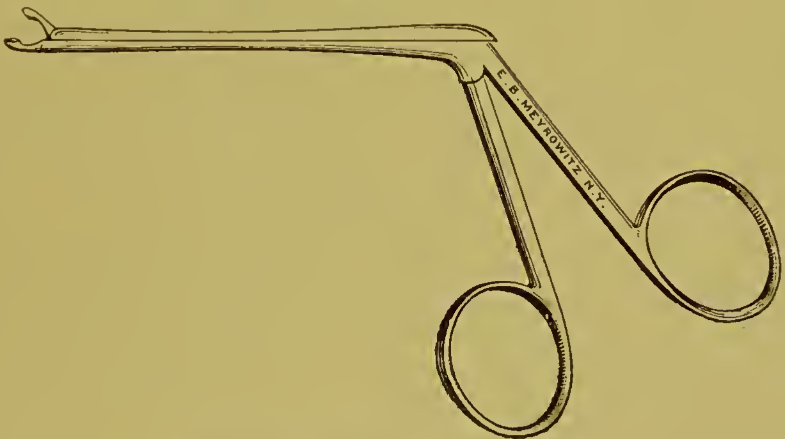
FIG. 588.



Blake's polypus snare.

In the **treatment** of chronic suppuration of the middle ear the first essential is thorough cleanliness of the accessible parts. Next comes the establishment of as perfect drainage as possible, and, finally, the removal of diseased tissue when not contraindicated. In order to meet the first two indications it is essential that any marked fibrous atresia or stenosis of the external ear canal should be remedied. Also that any polypi or polypoid granulations should be removed. Polypi, if large, should be removed by the aural snare, Blake's (Fig. 588) being a convenient form, under cocaine anæsthesia. Polypoid granulations may be removed by the sharp curette or by Hartmann's curette-forceps (Fig. 589) or by the use of caustics. After the re-

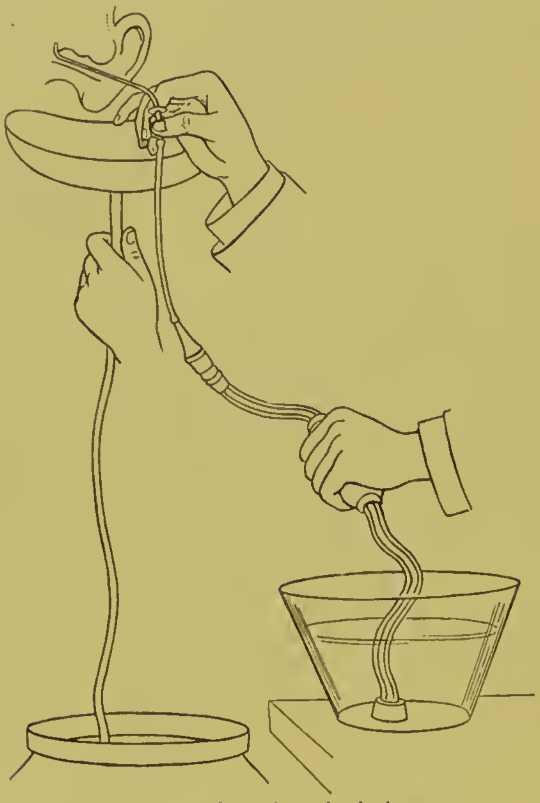
FIG. 589.



Hartmann's ear forceps with cutting edge.

moval of a polyp the base should be treated by curettage or cauterization. In applying caustics to granulations care must be exercised not to touch the skin of the external ear canal or any other part than the granulation; the granulating surface should first be thoroughly dried and, after the cauterizing application has been left sufficiently long to produce the desired effect, the excess should be syringed out. The usual caustics employed are chromic acid, trichloracetic acid, or the solid stick of nitrate of silver. A small bead of the solid silver stick or of the chromic or trichloracetic acid crystals should be fused on the end of a probe previously heated over an alcohol lamp. In sensitive patients the parts should first be cocainized. Always wait for the slough to separate before reapplying. The parts should be made as aseptic as possible before any of these operations, to guard against infection. It should always be borne in mind that the granulations may be an outgrowth from the exposed dura, and an attempt should be made with the probe to discover the true condition before undertaking any measures. Chromic acid applied to granulations in the region of the Fallopian canal caused an attack of herpes facialis from irritation of the nerve in one of the writer's patients; in another patient it set up an intense localized inflammation involving the facial nerve, which lay exposed under-

Fig. 590.

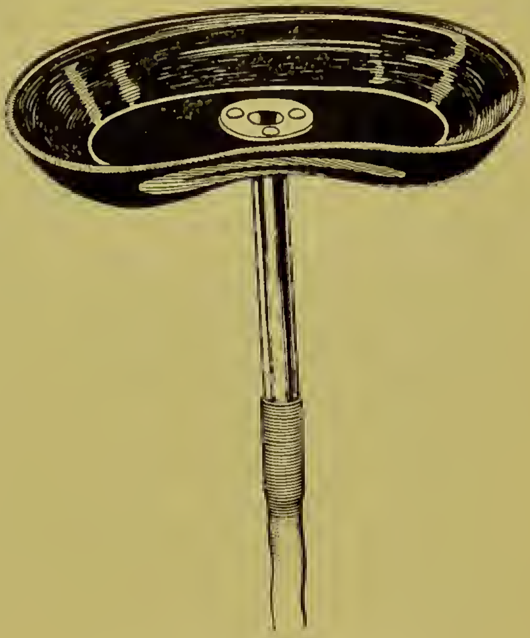


Author's canula and pus basin in use.

neath the granulations, and caused a facial palsy, relieved only by the radical operation. If the perforation is too small or pouting, it should be enlarged by excision, including a sufficient portion of the surrounding drum membrane. During the period that these measures to secure drainage, where necessary, have been instituted, the parts should be kept clean by syringing at home and at the office, after the method described in the treatment of the acute process. Likewise, attention should be devoted to the removal of any pathological conditions in the nasopharyngeal cavities, especially adenoids in children. Coincidently, improvement in the general health should be brought about, if possible.

For routine cleansing at the office, the writer is very fond of an apparatus (Fig. 590) that he has devised for use instead of the ordinary ear syringe. This apparatus consists of an Alpha "E" continuous flow syringe, made by Parker, Stearns & Sutton, of New York, weighted at the inlet to keep it in the solution, and provided at the nozzle with from two to three feet of small rubber tubing which carries the solution to a glass or metal canula for introduction within the ear canal. For ordinary syringing the glass surgical nozzle answers very well. Under illumination this canula is carried well within the orifice of the canal. The returning solution is caught in the pus basin devised by the writer, which has an outlet in the bottom fitted by means of a water-tight joint to a hollow metal tube from six to eight inches long and about one-half inch in diameter. This metal tube serves the purpose of a handle for the patient to use, and has a half-inch rubber tube attached to its lower end to carry the liquid into the waste receptacle. (Fig. 591.)

FIG. 591.



Author's pus basin for ear use.

At each visit the ear should be thoroughly cleansed by syringing with any good mild antiseptic solution. This procedure is much aided, whenever the tympanic mucous membrane is swollen or hypertrophied, by syringing out the discharge in the canal, then drying and applying to the mucous membrane a 1:5000 solution of adrenalin chloride. In a few minutes the mucous membrane will so shrink that a further syringing will empty many of the tympanic recesses which otherwise could not be reached, and so further the effect when a remedial application is made. The tympanic cavity must be thoroughly dried after syringing before any remedy is applied, whether by instillation or otherwise. Whatever remedy is used, it must never be forgotten that there is no panacea, and that no remedy can take the place of thorough cleansing and good drainage, and that every remedy derives its greatest efficacy from these measures.

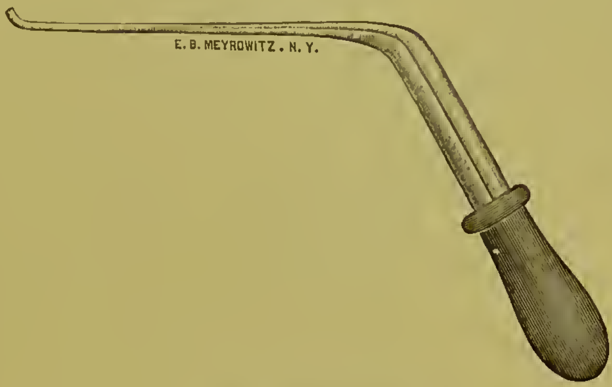
For home treatment the patient should syringe the ear two or three times daily with boiled water or mild antiseptic solutions, using a pint at a time, always, of course, warm; afterward drying out the ear canal thoroughly with absorbent cotton wrapped on a toothpick. When the patient complains of vertigo from syringing, remember that it is generally a matter of temperature—the water is used either too hot or too cold. In a few cases it may be necessary to syringe with the patient in the recumbent posture. The remedy to be used at home, after syringing, depends on the condition present in the middle ear. If the mucous membrane is hypertrophic, astringent solutions are indicated, such as chloride or sulphate of zinc (five grains to the ounce); if granulations are present, alcohol more or less diluted at first and containing boric acid or bichloride of mercury (1:5000); if fetor is present, the alcohol and bichloride solution or solution of permanganate of potassium (liq. pot. perman., ♏x–xl; aq., ℥iv). When there is a great deal of epithelial débris in the discharge and in the middle ear, peroxide of hydrogen may be used before syringing, to break up the collections. After leaving these various solutions, always warmed before using, in the ear for a few minutes, the canal should again be thoroughly dried out by means of cotton on a toothpick.

The above treatment may also be used at the office, and is much aided by a previous inflation of the ear to drive out any fluid retained by capillary attraction. The writer is also very fond of nitrate of silver in solution, the strength varying according to indications, usually beginning with from five grains to the ounce and increasing for effect.

In attic cases, with perforation of Shrapnell's membrane (Plate XXXV., Fig. 8), after syringing the canal, a Hartmann canula or that form of it as modified by the writer (Fig. 590), should be attached to the rubber tubing and, under good illumination, carried into the perforation so as to wash out the attic. Remedies may then be introduced into the attic by means of Buck's glass pipette (Fig. 592) or Blake's middle-ear syringe (Fig. 593), the former being just as efficient, much cheaper, and non-corrodible. Care should be taken not to use force in syringing into the attic.

As the discharge diminishes and the pathological conditions begin to disappear, resort may be had to one of the various forms of the so-called "dry treatment." Thus the patient, at home, may simply dry out the discharges instead of syringing, and may use insufflations of powder afterward once or twice daily. Very little powder should be used at a time. Pure, finely divided, boric-acid powder is probably the best all-round powder for this purpose. Occasionally boric acid irritates the mucous membrane, inducing a watery discharge, in which case its use must be discontinued. The same treatment may be used at the office. An aseptic gauze drain sometimes suffices to carry the patient from one office visit to another.

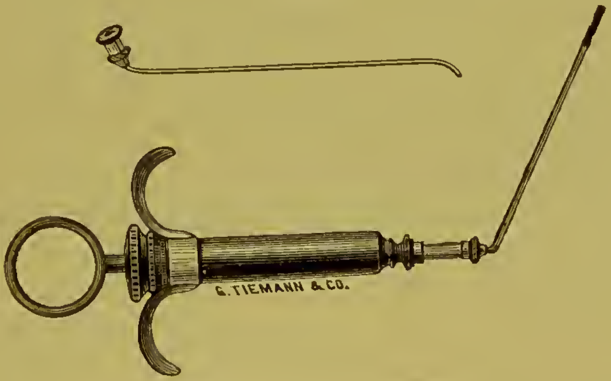
FIG. 592.



Buck's glass pipette.

If, notwithstanding a thorough and intelligent trial of these measures for a lengthy period (a number of months), the middle-ear inflammation continues, then the question of removing the ossicles comes up. Removal of the ossicles, however, even although they are found to be more or less carious at the first visit, should never be considered unless the above conservative treatment has been given a fair trial. And all carious areas in the accessible portions of the tympanic bony wall should first be curetted and placed in a healthy state. It has frequently been the writer's good fortune to see healing take place in cases that looked most unfavorable because of carious areas involving the tympanic walls and the ossicles. Ossiculectomy must also be considered, even although the process heals at times, if recurrences of the inflammation occur frequently with retention symptoms; but, where possible, the operation should be avoided if

FIG. 593.

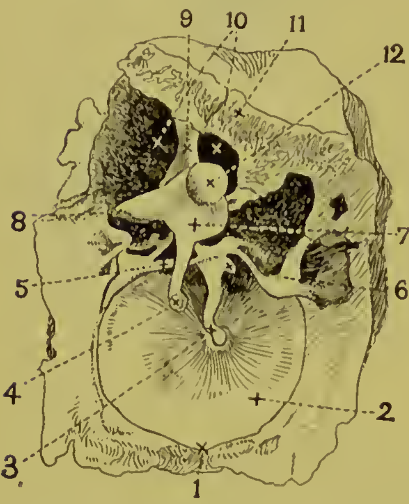


Blake's middle-ear syringe.

the hearing ability is anywhere near normal, for, while the operation frequently and generally improves hearing which has already been gravely impaired, it also in some cases makes the hearing much worse, and sometimes has been known to leave behind a paralysis of the facial nerve. In other words, the operation of ossiculectomy should not be considered simply because there exists a chronic purulent otitis media, if the latter is of a mild unirritating type and the hearing ability is serviceably good. Many patients live out the allotted span of life and many cases recover completely from a long-enduring suppuration, either by natural processes or by prolonged treatment.

Generally, however, the existence of an obstinate chronic middle-ear suppuration, with areas of caries on the ossicles and tympanic walls, and especially with periodical recurrences of symptoms of retention with or without gravely impaired hearing, is sufficient indication for the removal of the larger ossicles. (Fig. 594, and see Figs. 569, 571, and 573.) The frequent occurrence of giddiness and headaches and the presence of cholesteatomatous masses in these cases still further emphasizes the necessity for operative interference. The writer always does the operation with the patient sitting upright in a convenient chair and under the influence of nitrous oxide anæsthesia. This form of anæsthesia is preferred because of the quickness with which the patient is anæsthetized, the lack of danger, the ability to keep the patient in the most desirable position, and the rapid recovery from the effects, usually without nausea. Just before the anæsthetic is given the ear is made as nearly surgically clean as possible, and a warm 10 to 20 per cent. solution of cocaine hydrochlorate is instilled into the ear and left there for five minutes, after which the solution is thoroughly dried out. A warm solution of adrenalin chloride, 1:5000, is then instilled and also left in place for five minutes. A sufficient number of cotton pledgets wrapped on toothpicks has previously been prepared to wipe out blood. The patient is now anæsthetized and, under good illumination by reflected light, the operation is proceeded with. The remnant of the drum membrane is freed from all adhesions and a straight bistoury (Fig. 595) circumcises the membrane about a line from its attachment to the annulus, continuing down on each side of the manubrium to the

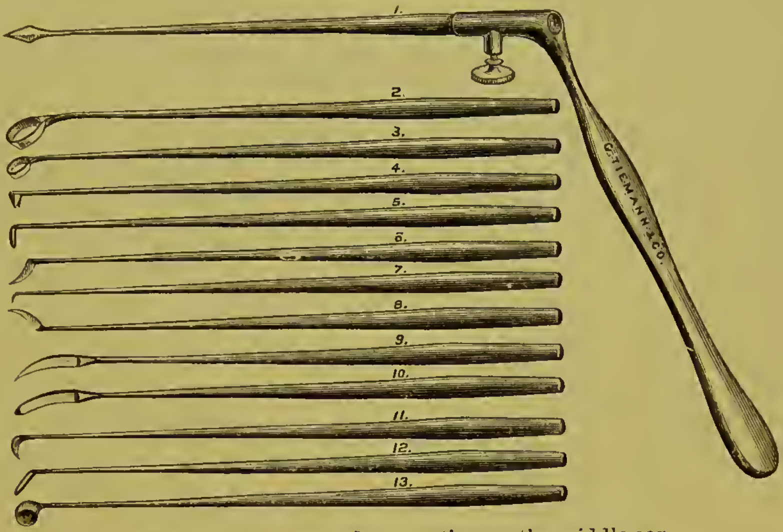
Fig. 594.



View of tympanic outer wall from within. 1. Annulus. 2. Tympanic membrane. 3. Hammer handle. 4. Long process of incus and os orbicularis. 5. Chorda tympani nerve in fold of mucous membrane. 6. Cut tendon of tensor tympani muscle. 7. Body of incus. 8. Short process of incus. 9. Suspensory ligament of hammer. 10. Attic. 11. Tegmen. 12. Head of malleus or hammer. (From a specimen in the author's collection.)

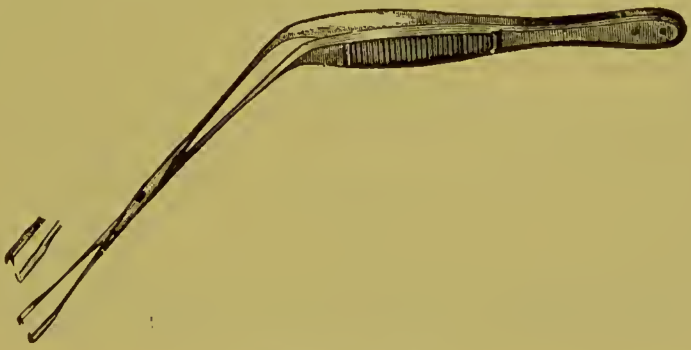
umbo; the detached membrane is then removed by forceps. The tendon of the stapedius muscle is now cut with the same knife. This is followed by dividing the incudo-stapedial articulation, if intact, by means of a sickle-shaped or spade knife bent at an angle and by severing the tendon of the tensor tympani muscle. To do the latter, the point of the sickle-shaped knife (Fig. 595, *6* and *8*) is carried upward under the posterior or anterior fold until the shank touches the fold, when the cutting edge is rotated forward or backward behind the malleus, so as to engage the tendon, which is severed by a sawing motion. The anterior and posterior folds are next cut through close to the hammer. The manubrium is now grasped close to the short process by McKay's (Fig. 596), or a fine alligator, or Hartmann's forceps (Fig. 597), and traction from side to side and downward exerted until the bone descends into the tympanum, when it is turned on its side and removed by one end from the canal. Very often the removal of the malleus brings the incus, generally its long process, into view, and

Fig. 595.



Hartmann's instruments for operation on the middle ear.

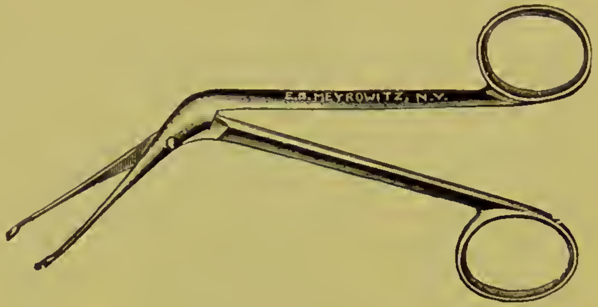
Fig. 596.



McKay's ear forceps.

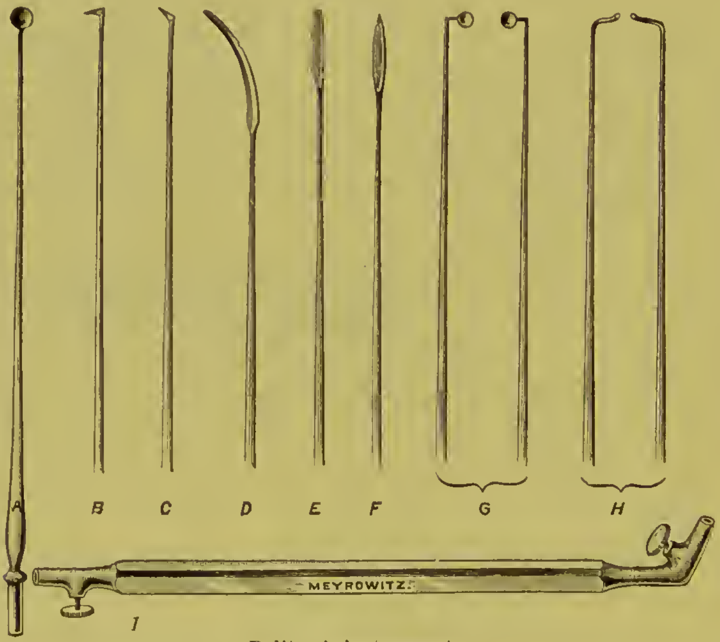
its removal then follows. Should the incus be out of sight, it is drawn down into the tympanum by means of Ludewig's incus hook (Fig. 598, *H*) or, what has served the same purpose in the writer's hands, by a right-angled spoon (Fig. 598, *G*). The hook or the spoon is carried up behind the *pars epitympanica* in a vertical position and as far forward as possible until the shank touches the bone. It is then maintained in the same position, but carried backward close to the inner wall of the *pars* until it reaches the position where the body of the incus should be, when the end of the hook or spoon is rotated backward toward the aditus until it engages the incus, which is then brought into view by traction in a downward and forward direction. The incus is then removed by the forceps.

Fig. 597.



Hartmann's ear forceps.

Fig. 598.



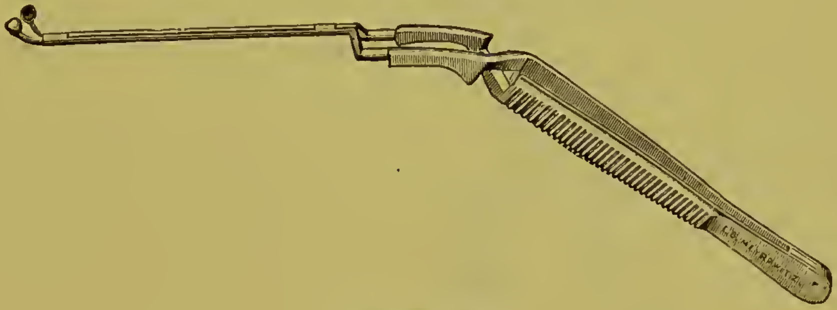
Politzer's instruments.

The use of cocaine and adrenalin makes the operation practically a bloodless one in the great majority of cases.

The chorda tympani nerve is almost necessarily destroyed, but the loss of taste resulting is very generally only temporary.

The attic is now syringed out with an antiseptic solution to remove pus and cholesteatomatous material, and what granulation tissue exists in the attic is carefully removed with the curette or with Allport's curette-forceps for use in the attic. (Fig. 599.) The curette should not be used in such fashion as to endanger the facial nerve or a possibly exposed dura. The probe should always first be used to discover any erosion of the tegmen. The writer has not made up his mind as to whether the introduction of a gauze wick at this stage is desirable or not; but, if used, it should be of plain aseptic gauze and not bichloride or iodoform, either of which may act as an irritant. When gauze is not used the ear is simply thoroughly dried and the concha filled with absorbent cotton held in place by adhesive zinc oxide plaster. The patient is instructed to lie as much as possible on the operated side to favor drainage. The dressings are to be removed at intervals of twelve to twenty-four hours for the next few days until all irritation has subsided. The patient is directed to keep in the recumbent posture, the diet is restricted, and the bowels are kept open.

FIG. 599.



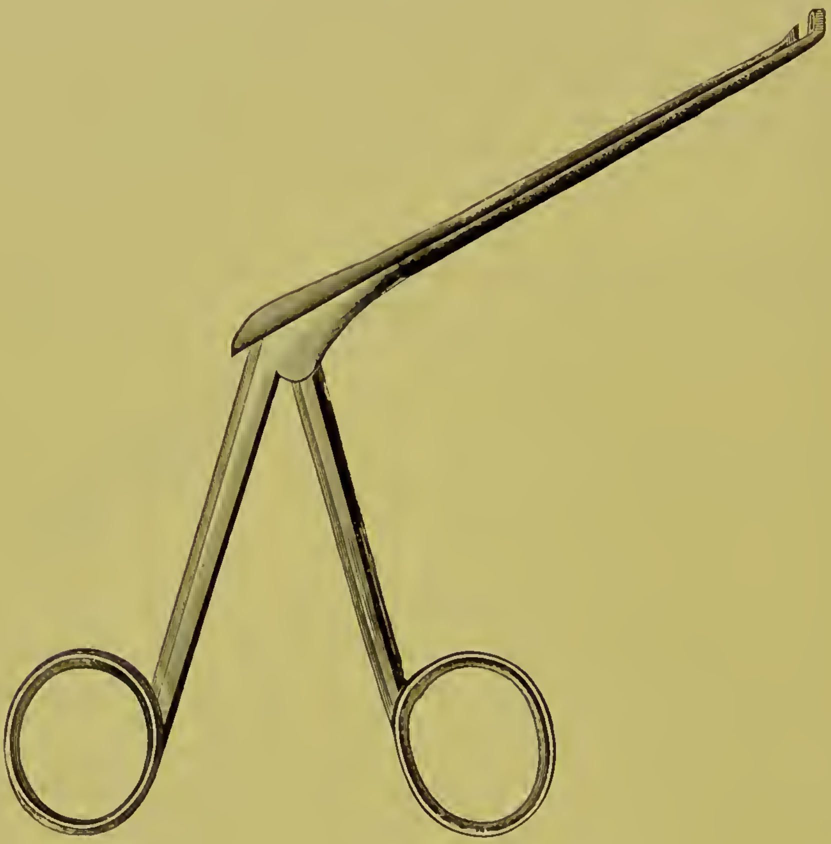
Allport's ear forceps.

Formerly the writer was of the opinion that the incus was frequently destroyed or that the portion left was so ankylosed to the neighboring parts as to be impossible of removal; but, with the increased expertness which comes from doing the operation frequently, he rarely fails to find some remnant of the body of the bone (Fig. 572), and suspects even then that a small fragment may have been pushed out of place by the manipulations. In fact, it has happened that the postoperative syringing has brought such a fragment into view. In but one case was it certain that ankylosis interfered with removal, and in this case, after fracture of the manubrium by traction, the ankylosis of the hammer head and incus to the surrounding bone was so firm as to turn the right-angled curette against the binding screw. Where the manubrium is brittle from disease it frequently fractures; but a hold can usually be obtained on a level with the short process by which to remove the rest of the bone.

When the *pars epitympanica* is found by the probe to be carious it may be removed in part by the use of Dench's punch (Fig. 600) which is the most satisfactory instrument for the purpose, although not as efficient as one would like. A secondary post-auricular operation, with turning out of the membranous canal and the use of the chisel, is much more efficient. Bacon recommends the use of a sharp spoon for this purpose.

Complete recovery immediately follows the operation in a certain proportion of cases; but, in the majority, after-treatment is necessary in order to bring about the cessation of the discharge and the cicatrization of the cavities. This after-treatment, in the writer's hands, consists in thorough cleansing of the affected attic, aditus, and antrum by means of absorbent cotton or syringing, using a special canula devised by him for this purpose (Fig. 601) and the Alpha "E" syringe, as described above. After syringing, the parts are thoroughly dried by means of cotton on a flexible applicator which reaches up into the attic, and even into the aditus, the head being bent forward from time to time to drain the antrum. The parts being dry, the indicated remedy in powdered form or in solu-

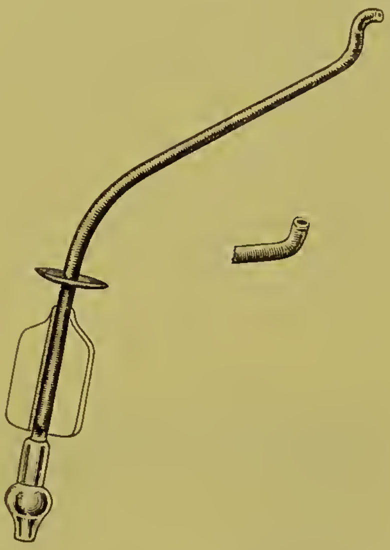
FIG. 600.



Dench's ear punch.

tion may be used. The patient is not permitted to treat the ear at home, other than to dry it out, if necessary, but is directed to call for treatment at the office, even so frequently as twice a day during the first few days after the operation. The time the discharge takes to reform indicates the intervals between treatments in the later stages. Treatment is kept up until the parts have remained free from discharge for from one to two years, the intervals between treatments toward the last being so long as two or three months, some scabbing, though no discharge, necessitating treatment.

FIG. 601.



Author's canula for syringing out the attic, etc. 1. For use after ossiculectomy. 2. For use in place of Hartmann's canula. The first is in two shapes, right and left. (Made by MEYROWITZ.)

Stucky reports 24 cures in 29 ossiculectomies. In 18 there was no improvement in hearing. The writer has taken notes of 22 consecutive cases of ossiculectomy in private practice, for chronic suppurative inflammation of the middle ear of long duration, many from childhood. Cure resulted in 15, 4 were improved, and 3 were not. Of those improved 2 were cholesteatomatous cases and only suffer at long intervals from some scabbing. Of those unimproved, 1 is a scrofulous girl in whom only the hammer was removed, 1 an anæmic hard-working woman, and the other a man. The hearing was made better in 13, remained about the same in 5, and was made worse in 2; unrecorded in 2. Two of the unimproved cases and one of the improved cases did not continue after treatment. In no case was the facial nerve involved.

Following ossiculectomy, patience and attention to detail often work a wondrous cure.

There is no doubt in the writer's mind that this operation should always be done by preference before undertaking the radical operation. He is certain that it will show as large a percentage of cures; it does not endanger life or health, and there is no resulting deformity. It almost invariably relieves the dizziness and headache, not due to intracranial lesions, when these have been present; but, as has previously been said, the operation is only a step toward cure, the after-treatment being fully as important.

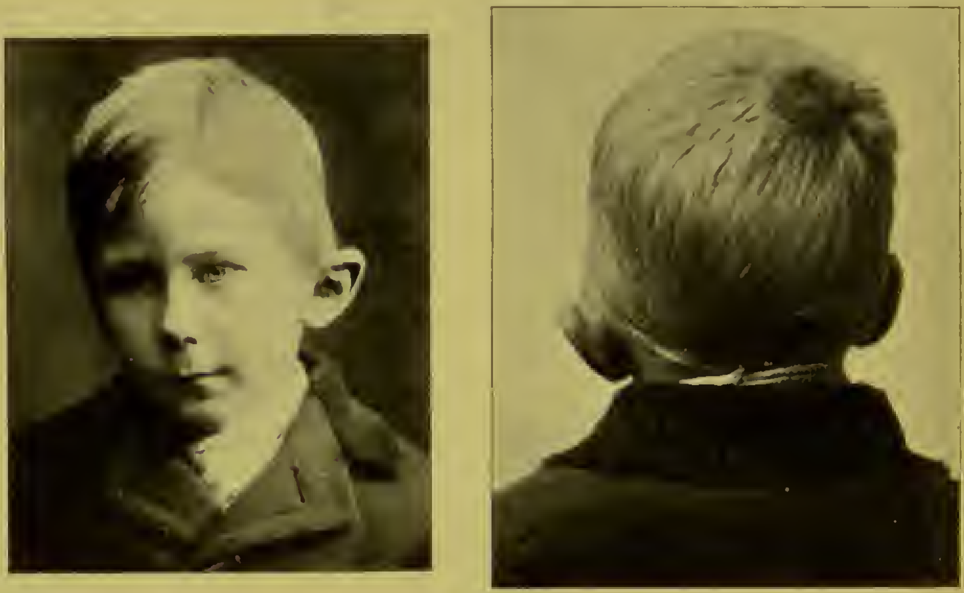
The radical operation will be described under the heading of Mastoiditis.

It is often desirable to attempt the improvement of the hearing in cases of otitis media purulenta chronica, which have healed with marked impairment of function through the formation of adhesions. This improvement may often be brought about by dividing and removing such bands where they bind down the incudo-stapedial articulation or the stapes to the fossa of the oval window. Where the hammer is bound down to the promontory division of the adhesion rarely improves the hearing; but when united to the incudo-stapedial joint, division followed by traction on the manubrium, or even removal of the manubrium, is sometimes very beneficial. Often the removal of the chalky plaques in the anterior and posterior quadrants of the drumhead will improve the hearing; thus the hearing for the whisper was permanently advanced from 4 feet to 20 feet by such an operation on one of the writer's patients.

A patient who has a healed chronic suppuration of the middle ear must be cautioned against the danger of getting water into the ear, either in sea bathing or in ordinary washing.

Acute Mastoid Periostitis. Rarely primary, it is then usually due to injury or to cold. It is generally due to extension from an otitis externa or from a purulent process in the middle ear. It is most frequent in children, and is usually due to extension from the mastoid cells or through the mastosquamosal suture. Occasionally a superficial abscess forms over the periosteum in the subcutaneous tissue; this form generally results by extension from furunculous disease of the external auditory canal. In children the pus from the middle ear sometimes dissects away the membranous canal from the bone and appears under the periosteum back of the ear: but even in these cases there is ordinarily involvement of the mastoid antrum. When the subperiosteal abscess has followed mastoiditis, it sometimes happens that large necrosed masses of bone are found in

Fig. 602. Fig. 603.



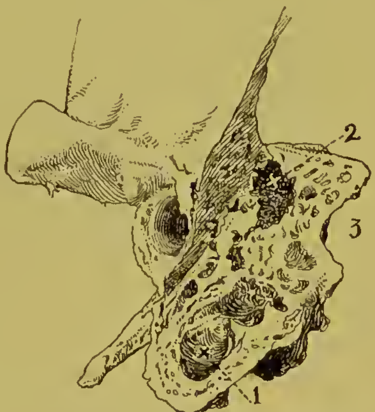
Front and rear view of such a case in the practice of the author.

the mastoid. The boundaries of the abscess are generally formed by the sutures, where the periosteum is adherent, and, as the periosteum is less adherent in an upward direction, the abscess tends to spread above, and even at times in front of the auricle, over the temple, and toward the eye, inducing great œdema of the affected side of the head. (Figs. 602 and 603.) It is a rare complication of cerebral abscess and is a usual accompaniment of an extradural abscess which has perforated the squamous portion of the skull and appeared externally. Chronic periostitis is a frequent accompaniment of sinus thrombosis if the mastoid vein is involved.

Prompt evacuation gives immediate relief, but the fundamental cause should be searched for and eradicated.

Mastoiditis. This condition occurs with about equal frequency in adults and in children; but the disease is much more frequently acute in children than in adults. Perforation of the mastoid cortex with subperiosteal abscess is more than three times as frequent in children as in adults. Intracranial complications occur much more frequently in chronic cases. Duel states that in from 4000 to 5000 cases of infectious diseases 26 mastoid abscesses occurred: 2 in measles, 2 in scarlet fever, 20 in combined scarlet fever and diphtheria, and 2 in combined scarlet fever, measles, and diphtheria. Edwin W. Pyle reports that 45 acute cases, mostly in children, furnished 33 per cent. of intracranial complications, while 55 chronic cases furnished 66 per cent. The mastoid (Figs. 578 and 604) is most frequently affected as the result of a recurrent purulent otitis media or as the result of exacerbation of a chronic process. In children it is more apt to follow an acute otitis media purulenta than in adults; also it is more apt to follow an acute influenzal otitis media.

FIG. 604.



Pneumatic mastoid. 1. Large cell in tip lined with mucous membrane. 2. Mastoid antrum. 3. Sigmoid groove. (From a specimen in the author's collection.)

The patients usually complain of pain, either deep within the ear or in the mastoid process. This pain frequently is of a throbbing character; in others there is present simply a dull aching pain. There may or may not be fever; usually, however, low fever is present, somewhat higher in the evening. Pulsating tinnitus is a significant symptom, as indicating intense vascular tension. Discharge from the ear is generally evident, although there are cases in which no discharge occurs and the drum membrane is intact. The discharge when unusually profuse is always indicative of possible mastoid involvement. Tenderness is usually present, except in those cases of long-standing chronic suppuration in which the mastoid process has become sclerosed or "eburnated;" in other cases, however, it may also be absent. The tenderness is usually most marked in one or all of three localities, either directly over the mastoid antrum, or over the tip of the mastoid process, or over that portion of the posterior-superior canal wall which overlies the position of the antrum. Swelling and redness in the neighborhood of any of the above three positions may be present, more often in children than in adults, and indicates the beginning of a periostitis due to the underlying disease of the bone. In Bezold cases, the swelling begins under the tip and spreads downward in the neck. Sleeplessness, due to pain, is an important symptom usually. Loss of appetite is frequently present, as well as a furred tongue, fetid breath, and constipation. Headache is complained of at times. In some cases, fistulæ opening on the external surface of the mastoid process or through the posterior canal wall may be present. In some, symptoms of cerebral irritation may appear. None of these symptoms are invariable; any may be absent in any particular case, and the intensity of the symptoms does not always serve as an indication of the amount of disorganization. It may happen that a number of these symptoms may coexist, and yet on operation the mastoid process may be found not involved.

The **diagnosis** is made by a consideration of the symptoms present, usually in connection with the presence of a suppurative process in the middle ear. A mistake may arise by confounding an external otitis with this condition; in external otitis the tenderness is usually limited to the auricle and most marked on traction of the auricle, there is swelling in the outer portion of the ear canal, the pain is not so deeply located, and rational treatment usually soon clears up the picture.

The **treatment** may be divided into the abortive and the operative. The abortive treatment consists in establishing as free drainage as possible through the middle ear and tympanic membrane by a generous incision into the membrane, carried along the posterior-superior wall of the osseous canal, when there seems to be present periosteal irritation in this region; frequent hot douching through the canal combined with the application of the hot-water bag over the mastoid process; withdrawal of blood in vigorous patients by the artificial or natural leech applied in front of the ear (it would be preferable to apply them back of the auricle did not the irritation from the leech-bites produce a localized tenderness which masks the clinical appearance afterward); rest in bed, light diet, the administration of cholagogue laxatives, and the exhibition of tincture of aconite root in minim doses every hour or two. Formerly the use of the ice-coil over the mastoid process was highly recommended by most aurists; but it was found that while it gave great relief to the pain, it so numbed the nervous supply of the parts as to mask the symptoms, the process within keeping on in its destructive work meanwhile. For the same reason it is not well to give narcotics, if it can possibly be avoided. Poultices are also objectionable, for evident reasons. Should no marked and progressive improvement in the symptoms follow immediately or soon upon the installation of the above treatment, then operation should be resorted to. The operation in itself is free from danger to life; the condition of the mastoid may and frequently does imperil it. Therefore, one should always err on the safe side and operate early. An unnecessary operation is much preferable to one that is done too late, and an early operation is the best prophylactic agent against intracranial complications. How soon disintegration of the mastoid may set in is well shown by the history of a case in the writer's service at the Kings County Hospital, Brooklyn. The patient, who was an alcoholic with a tubercular family history, was under treatment for a general complaint in the hospital. On a Saturday afternoon he began to complain of pain in his right ear, which began to discharge the next day without relief to the pain, and some fever and headache appeared. Monday morning the mastoid was tender over the tip and antrum, and toward afternoon swelling began below the tip. At 8 P.M. Monday, the writer operated and found a localized collection of pus in the cells of the tip and another purulent collection in the antrum and neighboring cells, with exposure of the dura over the tegmen antri. Between these two foci the bone was congested and softened.

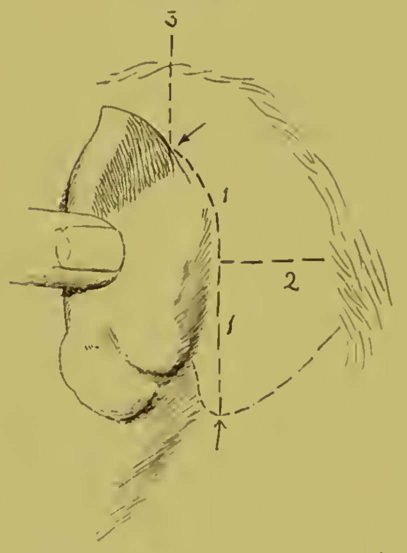
At the Brooklyn Eye and Ear Hospital, during the year 1900, 62 cases of mastoiditis were admitted, and 42 of these came to operation. As cases are not admitted to the hospital until the mastoid symptoms are prominent, this fairly well shows the proportion which can be aborted; in private practice, with earlier attention and better surroundings, the proportion should be greater.

The mastoid operation varies in extent from the original Schwartze operation, in which the mastoid cortex is perforated up to the antrum and which is appropriate to the cases of acute mastoiditis following acute purulent otitis media, to the so-called "radical operation," in which the cellular structures of the mastoid process up to the inner wall and including the tip, the posterior wall of the external canal above a line drawn diagonally from the floor of the orifice to the floor of the aditus, the *pars epitympanica*, and the larger ossicles are removed. The various modifications of the original Schwartze operation have simply been tentative steps toward the final radical operation; for instance, the Stacke, the Küster, etc.

The patient is prepared for the operation in the usual way, where possible, by a laxative the night preceding, followed by a saline in the morning and abstention from food for from four to five hours before the time set. The instruments and dressings are prepared in the way usual to all surgical operations. Half the scalp and the hairy parts around the ear of the affected side are shaven four or five hours before the time of operation, the parts thoroughly scrubbed with soap solution, washed over with alcohol or ether, then dressed with a moist bichloride pack and bandaged.

Just before operation, the patient being anæsthetized, the ear canal is first thoroughly cleansed with a bichloride solution of 1:5000, dried out and packed with aseptic gauze, and the skin in the region of the ear, neck, auricle, and scalp again scrubbed, washed with ether, and scrubbed with bichloride solution. The other half of the head, the neck, and shoulders are covered by sterile towels. In acute cases, if the membrane needs incision for better drainage, the gauze wick is now withdrawn, the incision made, the canal again dried out, and the gauze wick renewed. If an ordinary Schwartze operation is done, then the auricle is held forward by an assistant, and a scalpel or straight bistoury, held with the cutting edge at an acute angle to the line of incision and not perpendicularly, is inserted at a point a quarter of an inch above the upper attachment of the auricle to the side of the head, directly above the orifice of the external auditory canal and carried backward and downward parallel to the posterior auricular fold, and a quarter of an inch from it until the position of the antrum is reached, and from this point the incision is carried perpendicularly downward to the apex of the tip of the mastoid. (Fig. 605.) It should be the aim of the operator to reach the bone by this first incision; if this is not possible, then the periosteum must be divided by a second operation. The incision may, if the operator prefers, begin at the tip and progress upward; considerable hemorrhage follows, and should be controlled by the assistant with sponges until the bleeding vessels are caught up by hæmostatic forceps. There will still be present more or less general oozing after the large vessels are under control; but this usually soon ceases after the periosteum has been elevated. For convenience of exposure in the Schwartze, and as a necessity in the radical operation, a horizontal incision is made on a level with the centre of the external auditory canal, beginning at the primary incision and running backward for one inch. A periosteal elevator, guarded by the index finger of the left hand, is now inserted under the anterior and posterior flaps of the periosteum, and the membrane stripped from the bone forward to the posterior canal wall and backward for a space sufficient to expose the mastoid process. At the tip it is necessary to cut away the tendinous insertion of the sternocleidomastoid muscle with a pair of blunt curved scissors. Retractors are now applied, one to the anterior flap, including the auricle, and one to the posterior flap opposite. If the retractors have been placed on a level with the external canal the mastoid process is sufficiently well exposed and the surgical land-

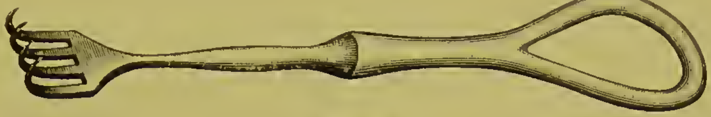
Fig. 605.



Lines of incision in operating on the mastoid. 1. Incision for the ordinary or Schwartze operation, continued upward; 2, for the "radical operation," and to enter the sigmoid groove or postcranial fossa; 3, for entering the middle cranial fossa, backward.

marks visible. (Fig. 577.) Above is seen the temporal ridge, anteriorly the posterior edge of the orifice of the external canal, with

FIG. 606.



Retractors.

FIG. 607.

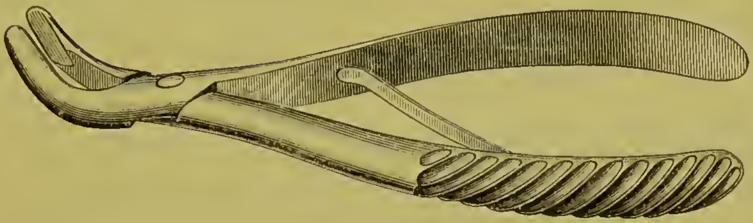


FIG. 608.

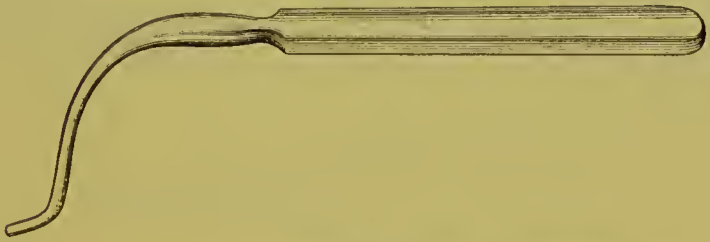
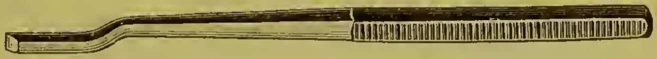
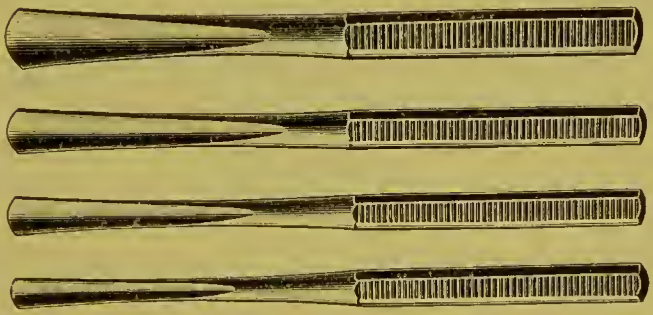


FIG. 609.



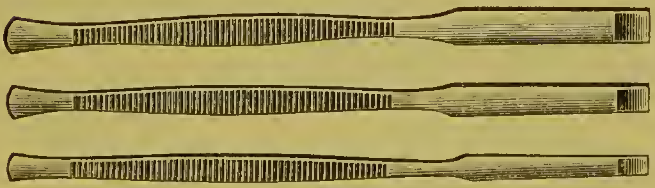
Schwartze's bayonet-shaped chisel.

FIG. 610.



Schwartze's straight aural gouge.

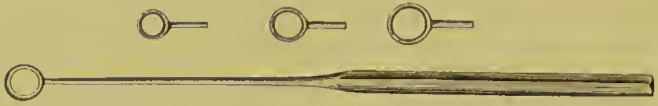
FIG. 611.



Schwabe's straight-edge aural chisel.

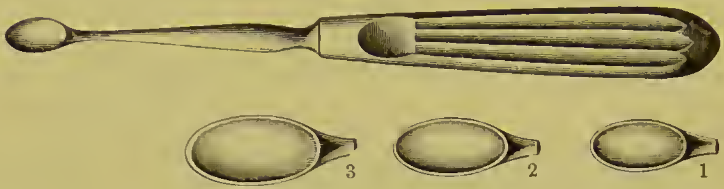
Instruments used in operations on the mastoid.

FIG. 612.



Buck's ear curette.

FIG. 613.



Oval mastoid curette.

FIG. 614.

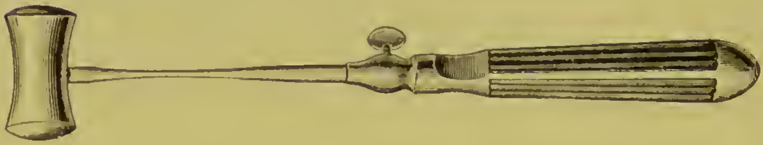
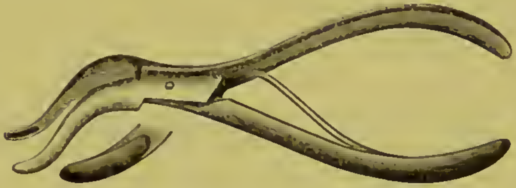
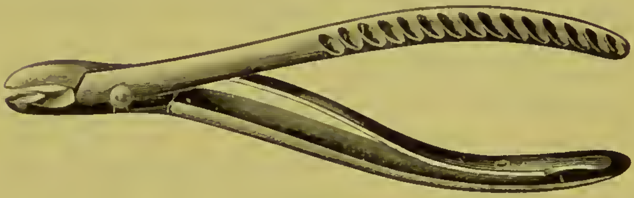


FIG. 615.



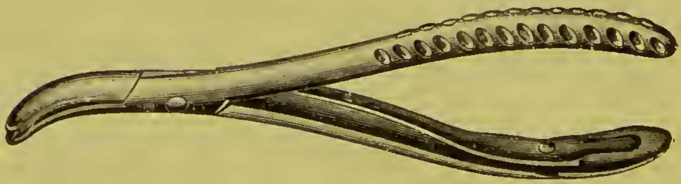
Mastoid guide and protector.

FIG. 616.



Hartmann's rongeur forceps.

FIG. 617.



Hartmann's rongeur forceps.

Instruments used in operations on the mastoid.

FIG. 618.

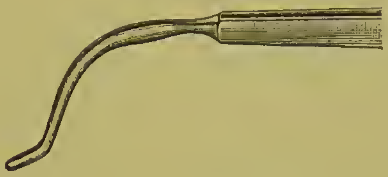


FIG. 619.

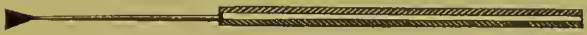
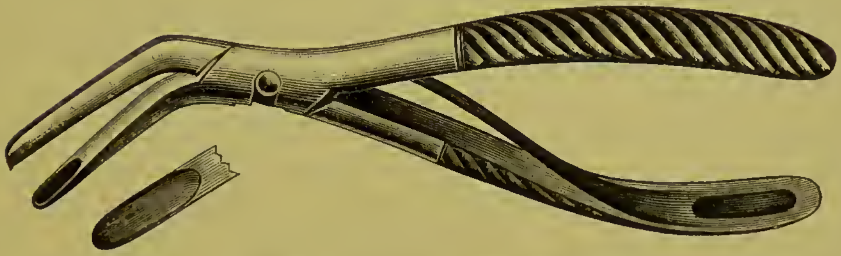


FIG. 620.



Stacke's protector for facial nerve.

FIG. 621.

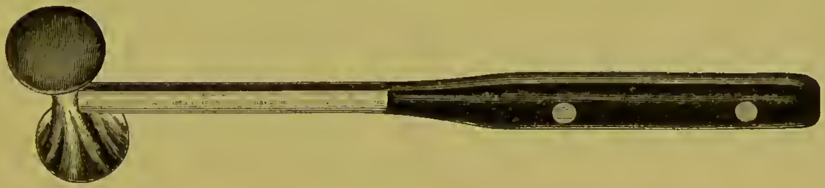
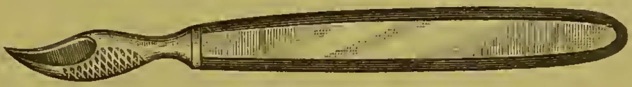
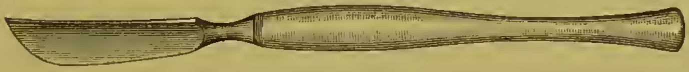


FIG. 622.



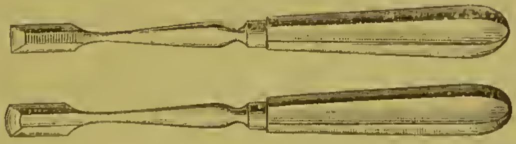
Politzer's knife.

FIG. 623.



Buck's knife.

FIG. 624.



Instruments used in operations on the mastoid.

the spina-suprameatum above, below the apex of the mastoid tip. Just behind and above the spina and between it and the temporal ridge is a fossa marking the position of Macewen's suprameatal triangle. It is now necessary, in the writer's opinion, to proceed with artificial illumination, preferably in the form of a good incandescent electric light, backed by a reflector, and held by an assistant in such a position that it thoroughly illumines the operative field without being in the way of the operator.

This method is much better than the attempt to direct light by means of the forehead mirror, which needs adjustment; this adjustment cannot be managed by the sterile hands of the operator, and is unsatisfactory when done by an assistant. The writer now takes a fair-sized gouge or chisel, about three-eighths of an inch broad, and with the hammer proceeds to drive the cutting edge, slightly inclined to the bone, into the cortex for an eighth of an inch along the line of an oval half an inch in its shortest horizontal diameter and one inch in its longest vertical diameter. The anterior edge of this oval lies about an eighth of an inch back of the posterior wall of the external canal, the upper edge lies an eighth of an inch below the temporal ridge, and the lower edge goes pretty well down to the apex of the mastoid tip. This button of bone is then lifted off from the underlying parts by a broad chisel held horizontally so as not to penetrate any deeper than an eighth of an inch into the bone; the button usually comes off in one piece. As a rule, the removal of this button exposes the cellular structure of the mastoid process, and it has never been deep enough to endanger the sinus, in the writer's experience. From this opening as a base a pyramidal section of bone is removed to the antrum, under illumination and the constant use of the probe. The upper surface of the pyramid is made to pass horizontally inward, care being taken not to penetrate the inner table into the middle cerebral fossa; the anterior surface of the pyramid passes inward parallel to the posterior canal wall in its upper part until it reaches the position of a line drawn from the floor of the orifice of the canal to the floor of the aditus; below this it gradually shelves into the inferior surface, which is cut out along an extension of this line to the tip of the mastoid; the posterior surface is inclined forward and inward, keeping a constant watch for the inner table overlying the sigmoid sinus. In other words the apex of the pyramid is directed upward, forward, and inward from the base. As the operator approaches the region of the antrum careful inspection is necessary to avoid the facial canal, the horizontal semicircular canal, and the middle cerebral fossa. The two former can usually be recognized by the greater compactness of their bony walls. When the antrum is reached a spoon is introduced and its external wall carefully reamed out. Before this, a spoon should only be used in cavities to remove necrotic bone, granulation tissue and pus, under the careful guidance of the probe. If the sigmoid groove encroaches well into the mastoid process, it is necessary to modify the operation by keeping above and forward of its position, which can only be recognized by the greater compactness of its bony wall. If the middle cerebral fossa dips down into the bone deeper than usual, similar precautions are to be taken, keeping the upper surface of the bone wound just below the inner table.

The object of every mastoid operation is to reach the mastoid antrum, and nothing short of this satisfies the indications. The antrum is now cleansed of purulent débris and granulation tissue and its walls searched for areas of erosion, which are to be curetted carefully, or for the presence of a fistula. In acute cases of mastoiditis following acute suppuration of the middle ear, it is better not to curette the aditus or attic for fear of disturbing the ossicular chain, and so impairing the hearing. The operation wound may now be gently flooded with sterile water or a mild antiseptic solution, no forcible injection being permitted to carry infected material into unaffected regions, or the wound cavities may simply be dried out with aseptic gauze sponges. The gauze wick is now removed from the external auditory canal and the blood and secretion dried out, after which the canal is finally packed with sterile gauze. The bone wound is then firmly packed with the same kind of gauze, which should be in the form of narrow strips with selvaged edges, so that no threads are left behind on its removal. Usually the bloodvessels in the soft parts are already occluded or are easily controlled by torsion; very exceptionally a ligature is needed. The incision in the soft parts is not sutured (except the horizontal portion), and the wound is then lightly packed with gauze. Over this a pad of gauze is placed posterior to the auricle and up against its posterior surface to give it support. Over all, auricle and wound, is now placed a larger gauze pad; this in turn is covered by a pad of wood-wool or Hudson's cotton dressing, which is held in place by strips of adhesive plaster.

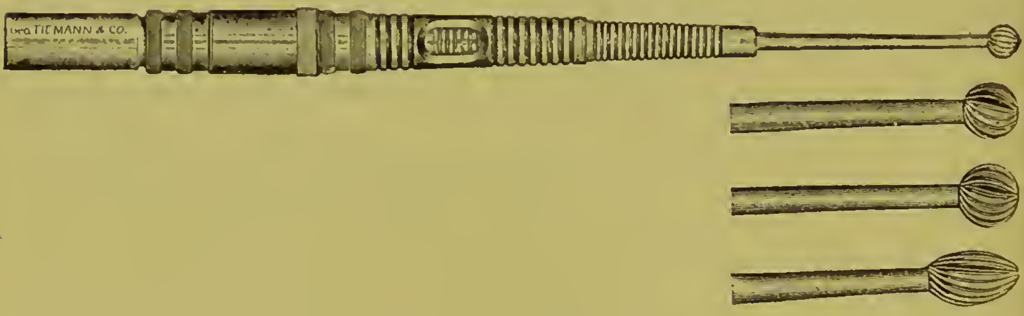
Finally, the whole dressing is included in a two-inch gauze bandage carried around the head, but not around the neck. In this way the dressing is kept firmly in contact with the head, and is not disturbed by changes in position which, after the oozings have hardened in the dressings, are so painful if the dressing has been loosely applied.

There are certain anatomical points to be remembered in doing a mastoid operation. In infants the antrum is the only cell in the mastoid process, and is nearly as large as in adults; in older children up to puberty the structure outside of the antrum is cancellous and does not usually become pneumatic until around or after puberty. Occasionally the mastoid process is double. The lower border of the posterior root of the zygoma is about on a level with the roof of the mastoid antrum and near the level of the floor of the middle cerebral fossa. (Figs. 604 and 627.) The depth of the antrum, in the adult, from the external surface of the mastoid process at the suprameatal triangle varies from one-eighth to three quarters of an inch, rarely so little as the former and occasionally deeper than the latter measurement. The writer does not believe that the antrum is ever absent or obliterated; he has examined between two and three hundred temporal bones taken consecutively from the dissecting-room without once finding this cell absent. The sigmoid groove may encroach so far into the mastoid process that its anterior wall is the posterior wall of the canal; but, usually, there is sufficient space in the region of the suprameatal triangle to go above it to the antrum. The depth of the inner tympanic wall from the posterior edge of the orifice of the osseous canal will indicate approximately the probable depth of the mastoid antrum. The facial canal should be looked for as the antrum is approached, lying as it does, just inferiorly and externally to the floor of the aditus; an assistant should keep watch for any twitchings of the facial muscles during this stage of the operation. Just above and internal to the facial canal, where it lies in relation to the aditus, is the external semicircular canal. Granulation masses should be removed carefully, under the guidance of the probe, in this region.

The number of assistants required varies; it is desirable to have, besides the anæsthetizer, one assistant to retract the anterior flap and sponge, one to retract the posterior flap and hand instruments, and one to hold the electric light, with one or more nurses to meet ordinary demands. Of course, every operator meets cases where he is fortunate if he has one assistant and a nurse besides the anæsthetizer.

Iodoform dressings, powder, and gauze are much used, but are apt to cause much irritation and even poisoning in sensitive patients.

FIG. 625.

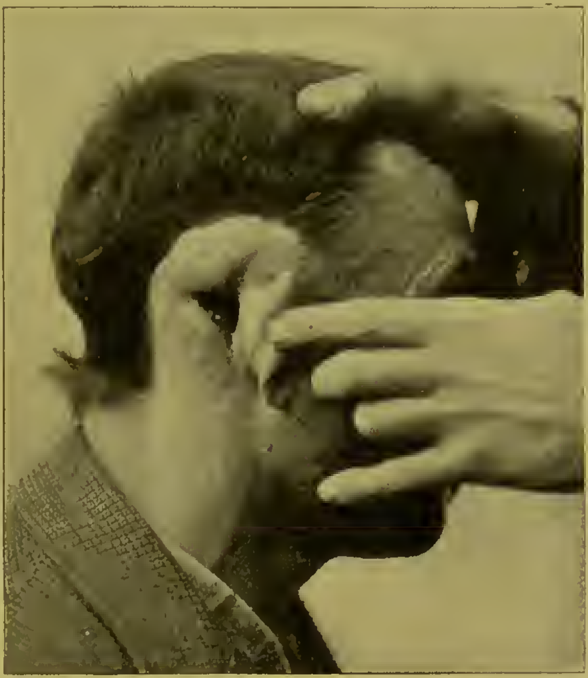


Macewen's burrs.

Macewen prefers the dental burr (Fig. 625) to the hammer and chisel; it should be of the globular form, with a very sharp and hard spiral cutting edge.

If the mastoiditis is of the chronic variety or follows a chronic middle-ear suppuration, then the Schwartze operation has to be modified to meet the indications, anywhere up to the so-called "radical operation." (Fig. 626.) The radical operation can never be truly radical, for it is an anatomical impossibility to extend the operative field to all the ultimate ramifications of the cellular structure in relation with the mastoid process and have the patient survive. It must always be a compromise, and as such the operator should not remove healthy tissue other than that which occurs in the ordinary line of operative attack, simply because it may chance to be anatomically related to the cellular structure of the mastoid. Stetter has shown that the radical operation as performed by its originators fails to cure in a considerable number of cases. The fact that this is so does not detract from the value of the operation in appropriate cases, but does emphasize the necessity of using ordinary surgical common sense in not attempting the impossible. For instance, it cannot be necessary to remove the tip of a densely eburnated mastoid when the entire pathological process is confined to the neighborhood of the antrum, aditus, and attic. Something has to be left to nature, and it is only our duty to make her work as light as possible. The radical operation is always indicated when a chronic suppurative middle-ear inflammation persists after thorough treatment through the canal, including ossiculectomy, especially when the patient complains more or less of periodical attacks of dizziness and headache.

FIG. 626.



Case of extradural abscess with perforation of both tables of the skull, about one and three-quarter inches above the orifice of the external auditory canal. The pus passed from the middle ear through the tegmen, stripped up the dura, eroded both inner and outer tables of the skull, and appeared externally under the periosteum. Never any mastoid tenderness. Temperature never above 99.5° F. Complained only of headache. A radical operation was done. Recovered.

In doing the radical operation, the writer thinks it best to remove the larger ossicles and remnants of drum membrane first, through the external ear canal, under nitrous oxide anæsthesia, with the patient in the upright position. After this has been done, the patient is let down to the horizontal position, and either nitrous oxide anæsthesia continued throughout the radical operation or the change quickly made to ether narcosis. In either case the primary stage of anæsthesia is greatly shortened.

The membranous external auditory canal is then separated from the bone, cut across by the periosteal elevator or by Stacke's knife, at its junction to the annulus, and withdrawn from the osseous canal by Hartmann's clamp or by a tape.

The antrum is reached in the ordinary way, and then (Fig. 627) all of the posterior wall of the external canal above a line drawn from the floor of the orifice to the floor of the aditus is removed by the combined use of the chisel and bone forceps. Sufficient of the superior wall of the canal is also removed with the *pars epitympanica* to give a good view of the tegmen tympani, making a smooth surface directly continuous with the tegmen. Stacke's protector should be introduced into the aditus during this stage of the operation to protect the structures of the inner tympanic wall and the horizontal semicircular and facial canals. The cellular structure of the mastoid tip is now removed or may previously have been removed to the inner table, and, finally, the mastoid tip is itself removed. The cavity of the antrum, aditus, and attic is now made smooth by the removal

FIG. 627.

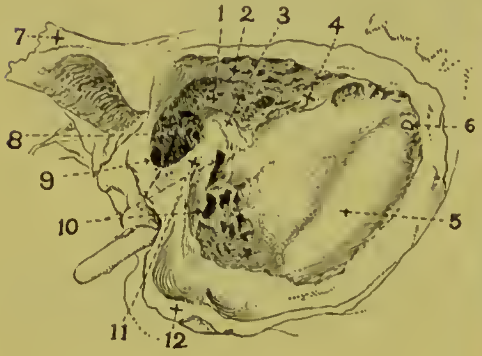


FIG. 628.

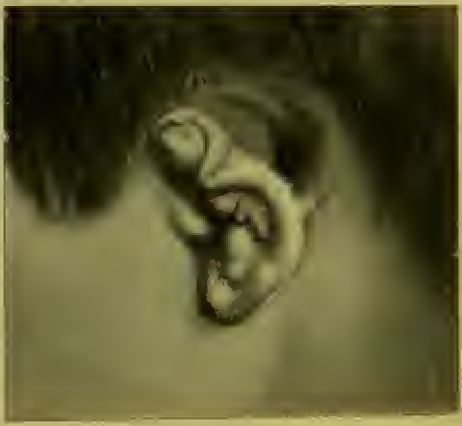


FIG. 627.—Appearance of bone operated upon after the "radical method," except that the tip and cells around facial canal have been left to give relative locations. 1. Aditus ad antrum. 2. Tegmen. 3. Horizontal semicircular canal. 4. Inner wall of antrum. 5. Wall of sigmoid groove. 6. Aperture for vein to sigmoid sinus. 7. Zygomatic process. 8. Fossa of the oval window. 9. Eustachian tube mouth. 10. Fallopian canal for facial nerve. 11. Posterior osseous external canal wall, cut off diagonally upward and inward. 12. Tip of mastoid process.

FIG. 628.—Deformity following a perichondritis and chondritis, due to incisions in the cartilage of the canal made in the doing of a radical operation. (From Trautmann's Operationen am Gehörorgan.)

of cellular partitions, and fistulæ searched for. If fistulæ are found the operation is to be extended according to indications.

Personally the writer does not believe in turning skin flaps formed from the posterior external cartilaginous canal into the bone wound; the folding of the skin makes the opening from the canal into the bone smaller, perichondritis and chondritis of the auricle (Fig. 628) are more apt to develop, and ceruminous collections are liable to occur wherever the skin containing ceruminous glands is carried. He thinks it much preferable to remove entirely the segment of the soft canal wall opposite the bone wound.

After operation, the parts should be thoroughly irrigated with a 1:5000 bichloride solution, unless the dura is exposed or a fistula exists, then care should be exercised and the entire cavity thoroughly dried out by pledgets of gauze. The tympanic cavity is then packed with small gauze pledgets, with or without the use of iodoform or iodoform and boric-acid powder, care being taken not to exert pressure in the region of the stapes. The aditus and antrum are then packed in the same way, after which the membranous and cartilaginous canal is replaced and held in position by gauze packing. Finally the mastoid cavity is packed and the wound dressed in the way described above with reference to Schwartze's operation.

The time during which the original dressing may be left untouched varies. If no contraindication arises, such as undue temperature, pain or complications, it may be left in place for a week or somewhat longer. There is quite an object in leaving it as long as practicable, in that by so doing granulation is well advanced and the first dressing consequently made less painful. It is sometimes desirable at the first dressing to administer nitrous oxide gas or to give previously a hypodermic injection of morphine and atropine, especially if the dressing is done so early that granulation has not occurred and the process is bound to be unduly painful.

Succeeding dressings should be done at intervals not greater than forty-eight hours. At each dressing all the antiseptic precautions taken at the operation should be vigorously imitated, and the dressings should always be done by a competent aurist.

Usually, in chronic cases, irrigation with antiseptic solutions is required. The wound cavities should always be firmly packed with pledgets of gauze as at the first dressing. The necessity and desirability of packing the bone wound firmly cannot be overestimated if a favorable result is to be achieved. Gradually the attempt should be made to pack the bone cavity through the external auditory canal, permitting the soft parts over the mastoid process to come together and unite. Where this cannot be brought about a posterior opening or deep hollow remains which gradually becomes cicatrized. (Figs. 629 and 630.)

As stated above, the majority of cases will result in cure of the mastoid condition and of the chronic purulent otitis media; but a certain number will fail to result in recovery of the purulent middle-ear process, especially if there is a cholesteatomatous condition present (Fig. 629) or if the operation has been done upon a diathetic patient. But even in these cases the safety against intracranial complications has been vastly increased.

FIG. 629.

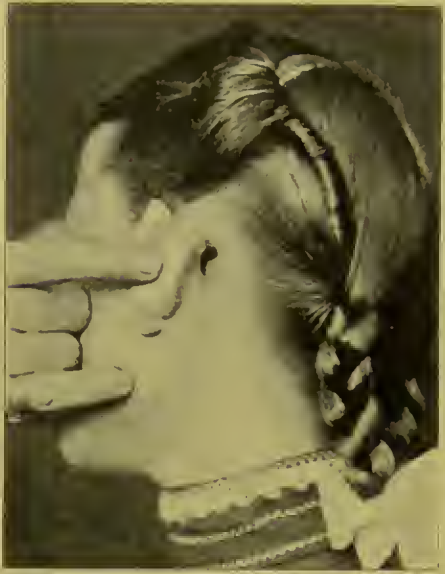
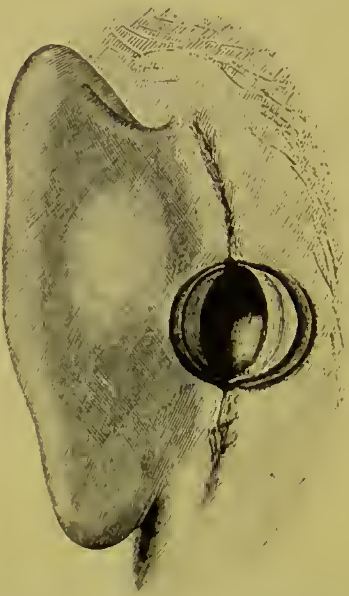


FIG. 630.



Showing persistent fistula, epidermized. Also the incisions in Trautmann's operation for its closure. The two inner flaps are sewn together, and then the two outer flaps are brought together over them and also sewn. (Trautmann's Operationen am Gehörorgan.)

Intracranial Complications of Suppurative Inflammation of the Middle Ear. These occur much more frequently than was formerly supposed. Those most commonly met with are external pachymeningitis with extradural abscess, subdural abscess and ulceration of the brain surface, leptomeningitis, cerebral or cerebellar abscess, and infective sigmoid sinus thrombosis. Pyle noted at the New York Eye and Ear Infirmary in 100 mastoid operations, 33 per cent. of intracranial complications in the cases of acute mastoiditis, mostly in children, and 66 per cent. in the cases of chronic mastoiditis. He did not state what relation these complications bore to acute or chronic suppurative processes in the middle ear, and he apparently classed among the intracranial complications simple exposure of the dura. Most observers state that such complications are comparatively rare as sequelæ of an initial acute purulent otitis media.

Pachymeningitis Externa with Extradural or Epidural Abscess. This is the most frequent of intracranial complications. A low grade of pachymeningitis externa frequently exists over the tegmen tympani or antri, caused by the underlying bone disease; it is chronic and essentially protective. The dura at these points becomes attached to the bone and much thickened by the development of fibrous tissue; but no pus or granulations exist between it and the bone. The patients at times complain of dull headache and sometimes have dizzy spells, both due to the localized irritation. In other cases, pus gains access to the dura and, stripping it from the bone, forms an extradural abscess; the dura is then usually coated with a layer of granulations, at the same time being thickened and hyperæmic.

Symptoms. Generally the presence of an extradural collection of pus is only discovered at the time of operating, unless it has found a way to the external soft tissues through the bone of the squama (Fig. 626) or alongside of the mastoid vein or through the condyloid foramen. Its presence may be suspected if the patient complains of continued lateralized headache, more or less dizziness, low fever (sometimes absent), tenderness, and perhaps swelling involving the deep cervical glands in the superior portion of the posterior cervical triangle; if there is an area of persistent tenderness over the squama or cerebellum, somnolence, occasionally nausea and vomiting, and sometimes stiffness of the neck, or swelling and tenderness around the exit of the mastoid emissary vein. Of these the most indicative are the lateralized persistent headache, with low fever or none at all, the areas of tenderness over the squama or cerebellum, and the tenderness and swelling in the superior posterior cervical triangle or over the mastoid emissary vein.

Prognosis is almost always bad, except when the pus finds an adequate outlet externally (which rarely happens), unless the case is operated upon. A thorough operation generally results in a complete recovery.

The **treatment** consists in the extension of the mastoid operation to the region affected. If the dura is exposed by carious erosion the area of erosion is to be enlarged until all parts of the pus cavity are under observation, if possible, up to the line of adhesion of the dura to the bone. Fistulæ in the dura are to be searched for and explored, with a view to possible complications. If the internal table is not broken through, then the middle or posterior cranial fossæ are to be artificially entered and the dura exposed according to the indications afforded by the symptoms. The pus is evacuated and granulation tissue removed, and the cavity dressed with powdered iodoform or iodoform and boric-acid powder, 1 part to 4, and iodoform gauze. If syringing is resorted to it should be done very gently. The writer believes in uncovering the dura of the middle or posterior fossa from the wound in the mastoid process upward and backward rather than in the use of the trephine.

Subdural Abscess. This condition is rare, and its diagnosis is practically impossible, the condition being found during operation. There is marked pain over the affected side of the head, the temperature runs higher than in extradural abscess (as high as 102° F. in McKernon's case), the pulse is more frequent than normal; evidence of sepsis, such as foul breath, furred tongue, pallor, and anæmia, may be present, and there may be more or less tenderness on the overlying portions of the skull. The inner table of the skull is usually eroded and the dura discolored. There is often superficial ulceration of the brain.

The dura is incised, the pus evacuated, and the cavity very gently syringed with a 1:10,000 solution of bichloride, precautions being taken to provide amply for the outflow. The cavity is now dried and the iodoform and boric-acid powder sifted in, after which it is loosely packed with iodoform gauze. No drainage-tube is required if the openings through the tegmen and dura have been sufficiently free.

Serous Leptomeningitis. The symptoms of this condition are very similar to those of cerebellar abscess: headache, dizziness, vomiting, constipation, often slow pulse, generally normal temperature, exceptionally fever lasting a day or so, optic neuritis in the majority. The patient is very restless, and delirium may alternate with sopor. Convulsive attacks or cramps were observed in one-third of the cases. Disturbances of sight are frequent. The occurrence of deafness, loss of taste and smell, while infrequent, point toward meningitis serosa when present. Serous meningitis and abscess frequently coexist; in over 50 per cent. of the cases of cerebellar abscess, according to Koch.

Quincke's lumbar puncture may be employed to determine the presence of an excess of arachnoidal fluid.

Treatment by depletion of all kinds, by inunctions, and by lumbar puncture may sometimes modify or even cure the disease. Operation to remove the infecting tissues is of first importance in the majority of cases.

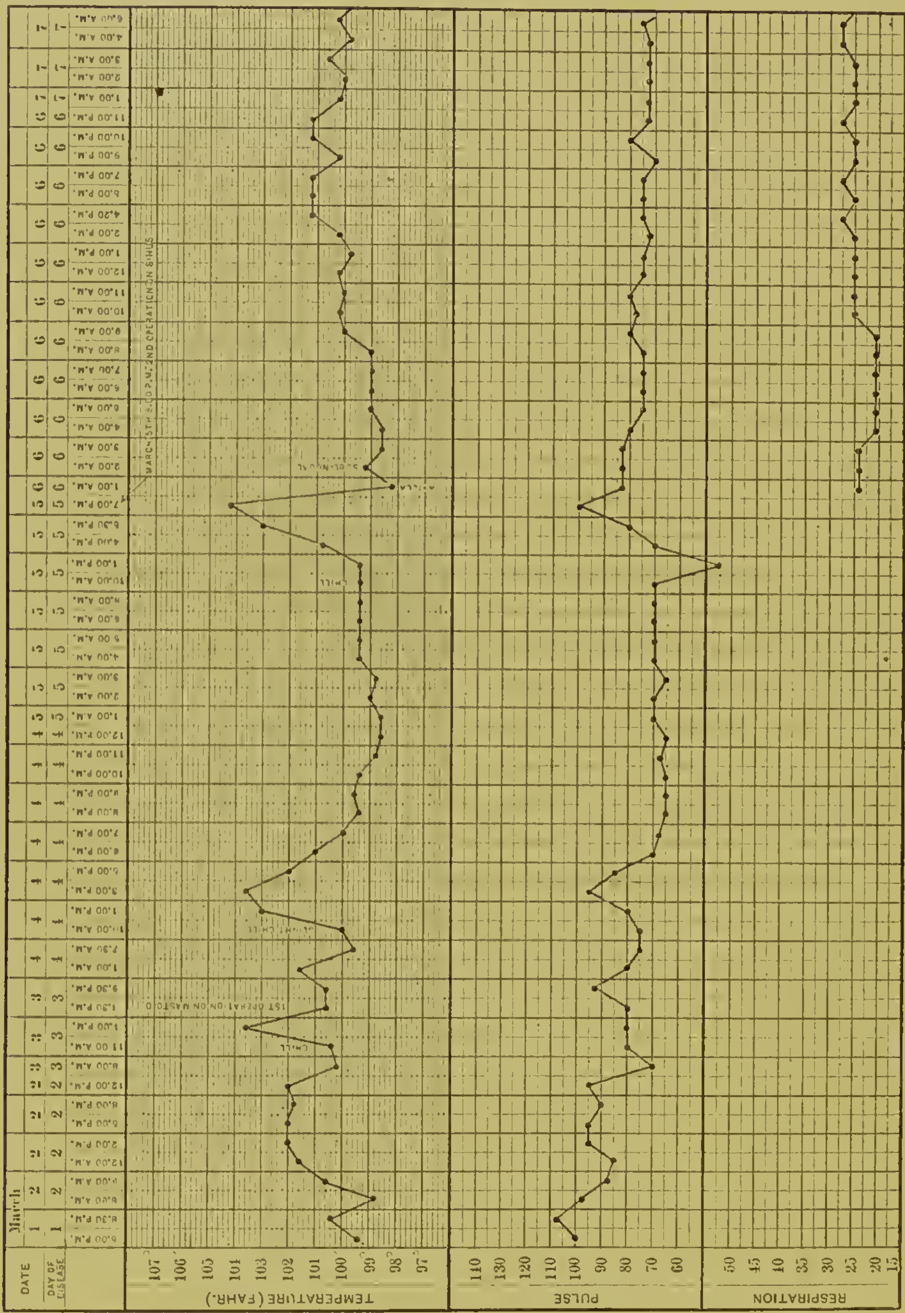
Purulent Leptomeningitis. This inflammatory process is apt to follow acute purulent otitis media in children who have the tubercular diathesis. It may follow pachymeningitis externa, with perforation of the dura or infective sinus thrombosis, or result from the rupture of a subdural or cerebral or cerebellar abscess. J. Orne Green states that "in more than half the cases it exists alone, and is due either to a general sepsis or to infection of the arachnoid and pia through the minute bloodvessels." It may pursue either a rapid course, ending fatally in from four or five hours to several days, or the process may be protracted up to two or three weeks. "It is the most serious and rapidly fatal of the pyogenic infective brain diseases." The onset is often marked by a chill. Headache is very intense, at first confined to affected parts, later becoming general, and at times subject to remissions; it usually appears early. Fever is apt to run high (104° to 106° F.), and may in the protracted form alternate with normal or subnormal temperature, but usually becomes continuously high toward the end. The pulse is usually more or less rapid, and constipation is usual. There are restlessness, irritability, dizziness, nausea, vomiting, over-acuteness of all the senses gradually passing on to delirium, convulsions, involvement of the cranial nerves, perhaps monoplegic or hemiplegic paralysis, drowsiness, and coma. Optic neuritis is infrequent. Aphasia is occasionally present. The surface of the body is generally hypersensitive to the touch. If the posterior cranial fossa is involved there is more or less spasm or rigidity of the muscles of the back of the neck. Macewen says "general cerebral meningitis, as a rule, affects both pupils equally, and they are then contracted until the pressure symptoms at a late stage supervene, when they both become dilated and fixed." Gruening has recently drawn attention to the occurrence of herpes facialis in the intracranial complications of suppurative otitis media, and he regards it as of grave significance. All his cases that had this symptom and one of Macewen's (the one first noted) died of leptomeningitis.

According to Green the "diagnosis is easy in the rapid variety, for the high fever, the excruciating headache, and the brain irritation, followed by paralytic symptoms, leave no doubt when the disease of the ear and of the bone has been already recognized. In the protracted variety the diagnosis is very difficult in the earlier stages; only when the serious disturbances of the sensorium set in can the diagnosis be absolute."

Cases of diffuse purulent leptomeningitis, with or without operation, probably always terminate fatally. When the process is more or less localized, early operation, with opening of the membranes, evacuation of infective intradural and extradural pus, and rendering the parts as aseptic as possible, has saved life in a few instances.

Infective Thrombosis of the Sigmoid Sinus. **Symptoms.** This condition occurs more commonly in adolescents and adults, in males, and on the right side. It occurs much more frequently than brain abscess. In a patient who has been complaining of the ear, with or without discharge, and of more or less symptoms referable to the mastoid process there suddenly occurs an exacerbation of most of the symptoms, except the discharge. The onset of this exacerbation is usually accentuated by the occurrence of a marked rigor which is often frequently repeated, followed by a high fever. There is often nausea or vomiting. Headache, if previously present, becomes intensified or now makes its appearance, often being referred to the neighborhood of the affected ear. The rigor is usually accompanied or followed by a profuse perspiration. The temperature (Fig. 631), which is subject to marked and rapid remissions, may rise as high as 106° F. The pulse is rapid, small, thready, and markedly fluctuating. The patient feels weak and sick, and has no appetite. Constipation at first, followed later by diarrhœa. Vertigo is not commonly present, and when it is it usually indicates a complicating meningitis. Respiration is moderately accelerated. The tongue is dry and coated, with offensive odor in the breath. The mind is usually clear, unless this condition is complicated by meningitis or brain abscess, in which case consciousness is generally lost in the course of the disease. Locally, there is generally otorrhœa from suppurative otitis media; exceptionally the tympanic membrane is intact. Tenderness over the mastoid is frequently present, especially in the neighborhood of the mastoid emissary vein, where œdema may also be present, sometimes extending over the whole mastoid process. In a good proportion of the cases, there is swelling and tenderness in the upper part of the posterior cervical triangle due to lymphadenitis of the deep cervical glands, to phlebitis of the posterior condyloid vein, or to the burrowing of pus which has passed from an extradural collec-

FIG. 631.



Clinical chart, showing temperature and pulse record in a case of infectious sinus thrombosis.

tion to the posterior condyloid foramen. Optic neuritis may or may not be present. The pupils are rarely affected. Some observers have noted the presence of turgescence of the veins in front of the head, brow, and face, because of the intracranial venous obstruction. In those cases in which the phlebitis has extended into the internal jugular there is usually sufficient induration surrounding the jugular to be recognized, and if the lymphatic glands become involved, marked and tender swellings appear in this region. As a rule, when infective sigmoid sinus thrombosis is complicated by cerebral or cerebellar abscess its symptoms mask those of the abscess.

As the disease progresses, evidences of the involvement of other parts of the body, generally by metastatic formations, may make their appearance. The lungs may be the seat of infective infarctions due to the lodgement of particles carried by the blood from the disintegrating thrombus. This frequently occurs toward the end of the second week, and may not at first give rise to physical signs. Thus an infective pneumonia may result. The patient complains of dyspnœa, frequent cough, "stitches" in the side, and "prune juice" expectoration makes its appearance. Every fresh purulent focus that forms is marked by rigors, intensified febrile movement, and profuse perspiration. The coarse râles become moist and the expectoration becomes purulent and putrid.

In other cases an infective enteritis is set up, either by ingestion of infective matter from the Eustachian tube or the lungs, or because of the general toxæmia developed. Vomiting is increased in frequency, there is abdominal pain, tympanites, or meteorism; diarrhœa of the fetid, putrid type, great prostration, and often muttering delirium.

When meningitis develops in the course of infective sigmoid sinus thrombosis, the headache becomes violent, the temperature remains continuously high, there is great excitement and irritability, hypersensitiveness, muscular contractions (tonic and clonic), or evanescent and fluctuating paresis, and later, delirium followed by coma.

Metastatic abscesses occurring in the muscles or articulations are marked by a rigor, increased fever, local pain and tenderness, swelling, etc.

The **diagnosis** in cases that develop typically is usually possible; but there are many cases in which the symptoms are not marked, and here the exercise of great discernment is necessary. In any case operation is necessary to clinch the diagnosis. Even if the pus is found issuing from the mastoid or condyloid foramens the diagnosis is not assured, as this simply indicates an extradural abscess; if, however, the mastoid vein is found thrombosed the diagnosis is made presumptively more certain. But suspicion is justified in any case of purulent otitis media if there is diminution or cessation of the discharge coincident with the appearance of cephalalgia, high temperature with marked fluctuations, rigors, and perhaps vomiting. As both the mastoid and condyloid emissary veins may be absent, external signs may fail.

Prognosis. Without operation most cases end fatally; but Macewen reports that "instances of long-standing obliteration of the internal jugular and sigmoid sinuses, in connection with infective caries and extensive disintegration in the temporal bone, have been discovered at autopsy." At the present time the percentage of recoveries after operation is greater with simultaneous ligation of the jugular than without; according to various statisticians from about 70 per cent. in the former to about 53 per cent. in the latter. Temperature as high as 106° F. indicates great intensity of infection and the probability that metastases or other unfavorable complications will develop. Recovery is probable if the case is operated on before metastases appear, supposing the operative attack to be thorough. But with the appearance of metastatic formations the gravity of the prognosis increases, thus Hessler found only 12 recoveries in 29 operated metastatic cases. Evidently, therefore, operative investigation should be advised just as soon as the condition is *justly* suspected, without waiting for certainty of diagnosis.

Treatment. As the percentage of recoveries with ligation of the jugular vein is higher than without, every operation should be undertaken with a view to ligation. But ligation is not to be practised until the sinus is uncovered and found to be thrombosed; the more so, since ligation is not a certain preventive of the dissemination of infective particles, which may find a way into the circulation through the posterior and anterior condyloid veins or through the occipital sinus. (Figs. 581 and 582.) But when the sigmoid sinus is found to be the seat of an infected thrombus, the jugular is best ligated before clearing out the infected clot, for fear that loosened particles may be carried down into the circulation during the operation. This also prevents the possible occurrence of aerial embolism, a fatal case of which has been reported by Kuhn.

The operation begins with a mastoidectomy which shall meet the indications existing within the middle-ear cavities. The mastoid tip and cellular structure is removed up to the internal table. The knee of the sigmoid sinus is generally on a level with the upper part of the osseous external auditory canal, and the depth of the sinus from the external surface of the mastoid process varies so greatly that the only safe rule is to look for it constantly after removing the external cortex. Of course, if erosion has already exposed the dura (Fig. 580) or a fistula exists, the difficulty is much simplified. Chiselling is to be resorted to until the dural covering is in view, when the exposure is to be sufficiently increased by the use of the bone forceps (Jansen's, Hartmann's, or Bacon's). The whole of the knee and descending portion of the sinus is to be laid bare. Sometimes it is also desirable to uncover a good part of the lateral sinus as well. In using the bone forceps, the dural covering should be pushed back away from the bone by a director, while introducing one blade of the instrument, otherwise the sinus wall might be nipped; this, however, has never happened in the writer's experience. The normal dura has a grayish-blue, glistening, tendinous appearance where it forms the sinus wall, whereas the same membrane looks very differently when a perisinus abscess or infected thrombus exists. The dura is then either covered with granulations, thickened and dulled, or discolored. The presence or absence of pulsation offers no certain indication as to the condition of things within the sinus, as such pulsation may be derived from the brain. If pus and granulation tissue cover the sinus they are to be removed to their uttermost limit and the cavity rendered aseptic before investigation of the sinus. The writer does not believe in the use of the aspirating needle to determine the condition of the sinus contents. Its findings are unreliable and its use may carry infection where none previously existed.

If now it is believed that the sinus is affected, then the next step should consist in ligation of the jugular. The skin of the neck having been already prepared, an incision is made along the anterior border of the sternocleidomastoid muscle, beginning above, at or near the lower termination of the mastoid incision, and ending below as far down as the clavicle, if there is reason to suspect thrombosis of the vein. The muscle is retracted and the vein exposed by opening the sheath. In two of the writer's cases the vein was quite collapsed and, therefore, difficult of recognition. This difficulty also exists if much infiltration and lymphadenitis be present, matting the parts together. If inflamed lymphatic glands are present they are to be removed. Then the vein is ligated at the upper and lower angles of the wound, care being taken not to injure the underlying hypoglossal or pneumogastric nerves or carotid artery. The facial vein needs ligation also. The vein is now cut across a short distance inside of each of the two ligations and, if found to be involved, resected.

Before opening the sinus wall the exposed parts should be carefully examined to discover any fistulous tract leading to the brain. If such tract is found it should be explored and the indications met before incising the sinus. The operation wound should now be gently flooded, not syringed, with 1:5000 bichloride solution, which is then thoroughly dried out and the cut surfaces of the bone protected by gauze pledgets while incision and evacuation of the clot is in progress. The incision is made parallel with the long axis of the sinus and as long as the aperture in the bony wall will permit. Fluid or grumous material is then mopped out, and the walls of the containing cavity swabbed out with sponges dipped in alcohol before a curette is introduced to remove the obstructing clot above and below. The clot in the lateral sinus toward the torcular should first be dislodged, by using the curette, until circulation is re-established; then the clot in the jugular bulb and upper vein is curetted out. If the jugular has been ligated, then the bulb may be washed out with a 1:5000 bichloride solution. Hemorrhage is controlled by pressing the outer sinus wall against the inner with iodoform gauze pledgets, outside of which the ordinary mastoid dressings are applied. Whiting recommends placing a pad of cotton over the jugular vein of the opposite side to minimize the pressure from the bandage around the neck. He also strongly counsels against "placing the nozzle of the syringe in the divided end of the jugular near the bulb and washing the contents forcibly upward and out of the opening in the sinus wall," for fear of disseminating infection.

In this, as in other prolonged operations on the intracranial contents, symptoms of collapse may appear, and stimulation must be resorted to; transfusion of about sixteen ounces of normal saline solution is the most immediately efficient, introduced either into the median basilic vein at a temperature of 108° F., into the cellular tissue of the abdominal wall, or injected into the rectum. Hypodermics of nitroglycerin, strychnine, or whiskey are also of service.

As was hinted at above, metastases may make their appearance after ligation of the jugular. If these occur in the lungs, kidneys, or liver the outlook is bad. If they are peripheral, the usual treatment of local pus collections is eminently successful.

Involvement of the lungs, digestive tract, or meninges is to be met by attention to these conditions along the lines in general use.

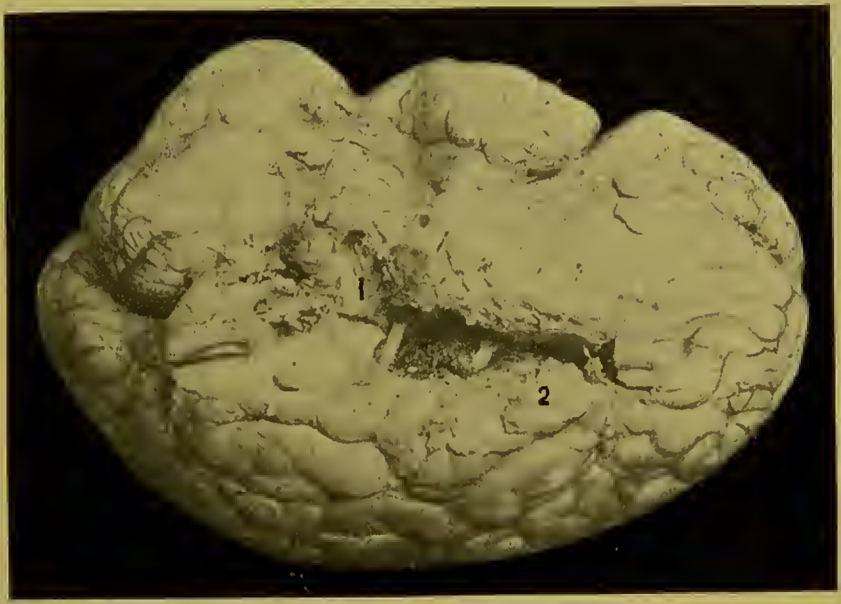
Infective Thrombosis of the Cavernous Sinus. This subject will receive attention in its relation to ear disease only. It is here always a sequel of the same affection in the petrosal or sigmoid sinuses. (Figs. 581 and 582.) It is frequently associated with basilar meningitis and occasionally with purulent thrombosis of the ophthalmic veins and abscess in the orbital cavity. Macewen reports that in more than half the cases the thrombus spreads through the circular sinus to the cavernous sinus on the opposite side. The symptoms indicating involvement of the cavernous sinus are exophthalmos, œdema of the eyelids and root of the nose, and more or less chemosis, all due to the venous obstruction; ptosis, strabismus, and pupillary manifestations due to paralysis produced by pressure on the nerves surrounding the cavernous venous plexus. Myosis is generally present at the outset; but as the pressure becomes greater *stabile* mydriasis ensues. Ophthalmoplegia may be complete toward the later stages. Defective vision exists, and later there is amaurosis from pressure on the optic nerve. If the other eye becomes affected it is a sure indication that the infective process has extended over to the opposite sinus. The symptoms are apt to become prominent, and then recede in one and then in the other eye, which fact forms a diagnostic distinction between inflammations confined to the orbital cavity and cavernous sinus thrombosis. Infective thrombosis of the other sinuses rarely gives pupillary symptoms, while the proptosis, *stabile* mydriasis, and blindness, first in one eye and then in the other, make the diagnosis easy in cavernous sinus thrombosis.

Besides these special localizing symptoms all the general symptoms of sinus thrombosis are present. The termination is invariably in death if the thrombus is infected; but if the symptoms arise simply from an obstructing clot by extension from the sigmoid sinus, and this clot does not become infected because of early operative interference, may not recovery be possible?

Infective Thrombosis of the Petrosal Sinuses. This condition simply forms a part of the natural history of infective thrombosis of the sigmoid sinus, whether the petrosal sinuses become affected primarily and later involve the sigmoid sinus, as rarely happens, or become affected secondarily by extension from the sigmoid, as generally happens.

Otic Cerebral Abscess. Pitt states that almost one-third of the cases of brain abscess are due to disease of the temporal bone. The vast majority of otic cerebral abscesses occur in the temporosphenoidal lobe. (Fig. 632.) They follow chronic middle-ear suppuration from seven to nine times as frequently as the acute process. They are generally connected with the diseased temporal bone by a fistulous tract. (Fig. 579.) Körner found that in 66 per cent. the abscess lay within the brain and was separated from the bone by normal brain tissue.

FIG. 632.



1. Primary abscess cavity connected with sinus in tympanic roof. 2. Secondary abscess cavity in temporosphenoidal lobe. Both abscess cavities found free from pus at autopsy. (BACON.)

The symptoms of brain abscess have been divided into four stages: the initial, latent, manifest, and, finally, the terminal. As a matter of clinical experience, it is generally only the two latter stages that come under observation; the first two stages give rise to indefinable symptoms which are usually attributed to the middle-ear disease or to other causes.

The symptoms during the initial stage, according to Macewen, are otalgia with excruciating neuralgic pains radiating from the ear, often vomiting, generally a rigor, slightly elevated temperature, coated tongue, prostration, and, as a rule, the otorrhœa ceases or lessens.

The symptoms during the manifest stage are of most importance for diagnosis, for it is generally in this stage that the patient demands relief. Von Bergmann has classified the symptoms of this stage into:

1. *General Symptoms.* Loss of appetite, furred tongue, foul breath, cachectic appearance, general lassitude and weakness, low temperature tending to intermit. There is usually no rigor, and emaciation often appears as the disease progresses.

2. *Brain and Pressure Symptoms.* Persistent headache, moderate and referred to the region of the abscess or to other parts; often, but not invariably, slowing of pulse, sometimes fluctuating; nausea and vomiting, dizziness, constipation, slow cerebration, and drowsiness are very commonly present; the patient is incapable of sustained attention; there is usually no delirium; tenderness on percussion over the affected area may be present; convúlsions of the extremities and of the facial of the opposite side may appear if the pressure is considerable; optic neuritis, usually slight, is frequently present, more pronounced on the affected side; respiration is regular and may be slowed. There is occasionally retention of urine followed by overflow, incontinence, and the urine sometimes contains albumin. The brain pressure seems to exert an influence in lowering both the temperature and pulse, since the moment pressure is relieved by evacuation of the abscess, Macewen says, there is a sudden rise in pulse-rate and temperature. But the abscess may exert no pressure, occupying the space of the destroyed brain tissue, and in this case the slowing of pulse and subnormal temperature will fail to appear. The eyesight is seldom much affected. Little dependence can be placed on the reflexes, superficial or deep.

3. *Local Brain Symptoms or Localizing Symptoms.* These are only occasionally present because the abscess is situated outside of the motor area, in the majority. Of the cranial nerves the third or motor oculi is most frequently implicated, on the same side. Hemiplegia of the opposite side is occasionally found in large abscesses, due to pressure or inflammatory action. "If one finds paralysis of the third nerve on the same side as the lesion, paralysis of the opposite side of the body, commencing in the face, answering to the tests of paralysis originating in the motor cortex and remaining most marked in the facial muscles, then involving the brachial muscles to a less extent, the lower limb remaining free, and all these being present without loss of sensation, the great probability is that the lesion is a large one situated in the temporal lobe" (Macewen). Facial paralysis, when central, is on the side opposite to the lesion, and cortical. The pupil is generally sluggish and, not infrequently, the pupil on the same side may either become myotic or mydriatic, accompanied by a degree of stability. Knapp believes homonymous hemianopsia, which has been noted in seven cases, would be found oftener if regu-

larly sought for. Aphasia sometimes accompanies left temporosphenoidal abscesses; sensory aphasia indicates involvement of the posterior portions of the temporal convolutions; motor aphasia, involvement of brain near the fissure of Rolando. Word deafness and psychic blindness, due to disturbance of the first temporal convolution and angular gyrus, have also been recorded.

The **diagnosis** is generally not possible until the manifest stage is reached, and even then it is often uncertain. Emaciation associated with headache, low temperature, slow pulse, and constipation in a case of chronic purulent otitis media should direct attention to the brain. Caries of the tegmen tympani or antri is a matter for investigation; sometimes pus may be seen oozing through an erosion in the tegmen tympani. The presence of an excessive discharge of pus is sometimes significant. The diagnosis is made easier if localizing symptoms make their appearance. In most cases the abscess is only found by following up the infective tract from the middle ear.

The duration varies from two to six weeks from the time of its formation in the case of an acute abscess, to a number of months or years in the case of an encapsulated chronic abscess.

There has been recorded but one case of spontaneous recovery from cerebral abscess. If not interfered with, death finally results from profound exhaustion, probably the most common termination, or by rupture into the ventricles or on to the surface of the brain, or by the development of complicating sinus thrombosis and meningitis. Death occurs with gradually deepening stupor and coma in case it is due to cerebral pressure and œdema. If rupture into the ventricles takes place, the pupils become widely dilated, the face livid, respiration greatly accelerated, the temperature rises to 104°–105° F. and the pulse to 120; there occur muscular twitchings all over the body, possibly convulsions and tetanic seizures, followed by coma and death in from six to twelve hours, as a rule. Rupture on to the surface of the brain sets up an acute leptomeningitis, unless adhesion of the membranes has previously taken place, in which case the pus may find its way to the skull wall, and so externally. Even when discharge of the pus thus takes place through the bone, it is a question whether permanent recovery ever takes place.

The result of surgical interference is very promising if the pus can be thoroughly evacuated and the abscess cavity rendered aseptic. Often there is left behind no impairment of the mental or bodily functions. Macewen obtained 8 recoveries in 10 temporosphenoidal abscesses.

The temporosphenoidal lobe may be uncovered by the use of the trephine or by continuing the use of the hammer and chisel upward from the mastoid wound to the squama, the mastoid incision having been previously extended upward for a sufficient distance above the auricle. (Fig. 605.) In every case the antrum should be opened first and the middle-ear cavities explored, especially over the tegmen of the tympanum and antrum, for the presence of a fistulous tract. If such a tract is found, the operation should be extended to conform to the direction it takes. Without the existence of a fistulous tract, the operator may chisel upward from the mastoid wound until the dura is exposed for an area large enough to admit the biting blade of a pair of bone forceps, after which thorough and extensive exposure is easy. The exposure of the dura should be sufficient to make possible the thorough exploration of the tegmen tympani and antri. The dura is to be rendered thoroughly aseptic by scraping off granulations and treating with antiseptics before the attempt is made to explore the brain through it. The dura will usually be found discolored over the site of the abscess and the brain should be incised with a straight bistoury at the centre of the discolored area, care being taken not to penetrate far enough to endanger the ventricle; the knife may be carried to a depth of one inch with safety. Macewen recommends the use of an exploratory canula devised by himself; but it seems to the writer that the bistoury is more certain and no more dangerous. If the abscess is of considerable size it will produce bulging of the brain into the bone opening, which may help to locate the abscess. In opening the dura do not extend the incision quite to the margin of the bony opening, so that if a vessel is divided it may be easily secured. If the trephine is used, the centre-pin of a half-inch trephine is placed at a point three quarters of an inch above the posterior root of the zygoma on a line with the posterior wall of the external osseous canal. Personally the writer prefers the method of enlargement of the mastoid wound with the hammer and chisel and bone forceps; the aperture may be made large enough to meet any indications.

After the abscess has been incised and the pus evacuated, a blunt curette or a pair of forceps should be used to remove any sloughs that have not been carried out by the pus. At the present time, the preponderance of opinion seems to be against washing out the abscess cavity. If washing out seems desirable, then a very weak antiseptic solution is to be syringed gently into the abscess cavity through a canula, alongside of which a much larger canula for the outflow has been simultaneously inserted. If any resistance to the current is met with, the tubes are to be withdrawn, cleansed, and the attempt made over again. No force is to be used. After the stream returns clear, the head should be inclined to the affected side to drain out the fluid before withdrawing the tubes. Whiting has invented an instrument which he calls an encephaloscope, consisting of a tube with an obturator, for the purpose of examining the interior of the abscess cavity and, on withdrawal, the fistulous tract. He also introduces gauze drains through it. Decalcified bone drainage-tubes may be used or the cavity may be lightly packed with gauze, after dusting with the iodoform and boric-acid powder. The outer dressings are the same as for the mastoid operation.

If all goes well the first dressing may be left in place for a week or so, provided the temperature is normal and there is no stain through the dressings. After the first dressing, the wound should be dressed daily, with or without syringing. If powder is used, boric acid should now be substituted for iodoform to avoid iodoformism. The patient should be kept in bed for from four to six weeks and on a milk or fluid diet for two or three weeks. If the bowels have not moved spontaneously by the end of a week a mild purgative should be given. The patient should not be permitted to leave the recumbent posture until the wound is well on the road to healing.

After evacuation, the abscess walls sink into apposition and the cavity becomes quickly obliterated, as a rule. Often adhesions form between the brain and dura or fibrous tissue at the opening in the bone; sudden movement is then apt to cause shock, with faintness or transitory unconsciousness.

Otic Cerebellar Abscess. Abscess of the cerebellum occurs usually in one hemisphere, generally in the anterior portion. The majority are in more or less direct contact with the sigmoid sulcus. Koch believes many of the abscesses occurring in connection with chronic middle-ear suppuration are acute abscesses caused by a recrudescence of the trouble.

The general, brain, and brain pressure symptoms are much the same as in cerebral abscess. Localizing symptoms may be altogether wanting, and frequently are.

Excessive vomiting is more apt to be present; headache is never wanting and is usually occipital, but may be referred to other parts; the speech is sometimes jerky and syllabic; optic neuritis may be present, but is of no special significance. Marked dizziness is present in about one-third of the cases. Macewen attaches significance to rigidity of the masseters. There are disturbances in equilibrium, in gait, in breathing, and in motor speech. Amaurosis, without atrophy of the optic nerve, may be present. "There may be total blindness, probably attributable to severe hydrocephalus internus. As no case of temporal abscess has, as yet, been accompanied by double amaurosis, this complication is of diagnostic value" (Koch). Convulsions occur especially in children, and probably indicate the presence of internal hydrocephalus. Paresis of the facial nerve of the same side may occur. As meningitis develops, retraction of the head and neck makes its appearance. Herpes facialis was present in Case XL. of Macewen's; the patient died. Macewen notes that patients often vomit when raised from the recumbent posture. Weakening or paralysis of the bladder and rectum are more apt to occur than in cerebral abscess. Cerebellar abscess only occasionally involves the motor oculi. Double-sided involvement of the cranial nerves is rare; rarer still is crossed affection of the nerves. The nearer a cerebellar abscess reaches to the middle line, the more it is apt to produce focal symptoms.

If the abscess occurs in the pons, localizing symptoms may not appear unless the abscess is large, in which case crossed hemiplegia, double hemiplegia, or other lateral, bilateral, or shifting palsies may be present, according to Dercum. Oculomotor symptoms may also exist. In some cases the symptoms present are referable to the overlying meningitis, the abscess itself producing no symptoms, or the abscess symptoms are masked and overshadowed by those of a coexisting sigmoid sinus thrombosis.

Koch noted a close following of the abscess upon the ear affection in one-half of the cases. In others the interval may vary from several weeks to several months. The length of the terminal stage varies from three days to two and one-half months, the average being two weeks. Macewen observed one case in which abscess symptoms had been present for eleven months.

In one-half of the cases the final cause of death was not determined; meningitis caused death in one quarter, progressive encephalitis in some, rupture into the fourth ventricle, hydrocephalus internus, sinus phlebitis, or some other complication in others. Death sometimes results from the encroachment of the abscess upon important centres, such as exist in the medulla.

As with cerebral abscess so with cerebellar, the diagnosis is usually only determined with certainty by operative investigation.

The natural termination is in death; by means of operative interference about 50 per cent. of the cases may be saved.

The **treatment** consists in operation. The horizontal incision from the mastoid incision is carried backward, so as to uncover the occipital bone over the situation of the cerebellum. The sigmoid sinus is then uncovered for investigation and the bone wound continued backward over the cerebellum by the use of the bone forceps. As most cerebellar abscesses are situated in the immediate neighborhood of the sigmoid groove, the operation through the mastoid has great advantage over the method of trephining behind the process; it also enables us to examine the sigmoid sinus at the same time. The remarks made as to locating, evacuating, and dressing cerebral abscess also apply to cerebellar. In the latter large sloughs of brain tissue in the abscess cavity are rare.

In operating, sometimes suspension of breathing suddenly occurs, due to the anæsthetic increasing the œdematous condition of the brain. When this happens, the operation should be quickly proceeded with to evacuate the abscess and relieve the pressure exerted on the respiratory centre, meanwhile using artificial respiration. If the period of anæsthesia is shortened by the preliminary administration of nitrous oxide gas this unfortunate occurrence is less apt to manifest itself.

Differential Diagnosis. The fact of the existence of suppurative process in the middle ear is of great help.

In leptomeningitis there are high temperature and rapid pulse without marked remissions, irritability, general excitement, restlessness, and hyperæsthesia of the sensorium.

In infective sinus thrombosis there are mental depression, rigors, constipation, markedly fluctuating febrile movement, and irregular frequent pulse.

If the temporosphenoidal abscess be large we may have oculomotor and pupillary changes, weakness and convulsions of the opposite side of the body, perhaps various forms of aphasia, and, possibly, optic neuritis.

In cerebellar abscess there are excessive vomiting, rigidity of the back of the neck, staggering gait, "cerebellar speech," and vertigo.

In both brain abscesses there are slow pulse and low fever, sometimes subnormal temperature, slow cerebration, apathy, and drowsiness; but the fact that more than one intracranial pathological condition often coexists in the same patient should never be overlooked, and we should be guided in our diagnosis and operative interference by the remembrance of this fact.

CHAPTER XXVIII.

CHRONIC NON-SUPPURATIVE MIDDLE-EAR DISEASE.

By ARTHUR H. CHEATLE, F.R.C.S. Eng.

Examination of the Patient. This should be carried out with great care and thoroughness in order that a proper diagnosis can be made, and also that the surgeon should be able to give a prognosis, which is often of great moment.

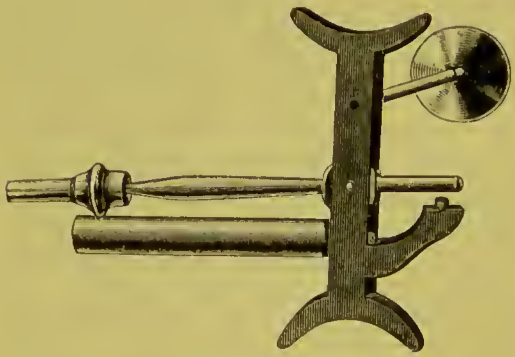
The family history should be first inquired into for evidence of heredity. The life-history of the patient himself must then be investigated from a general point of view. Then will follow the history of the mode of onset and progress of the aural trouble.

All these things having been noted, the examination of the patient can be made. This is never complete unless both ears, the nose, the pharynx, the nasopharynx, together with the general health and surroundings have been minutely inspected and inquired into. It is always wise to make careful notes and drawings as the examination proceeds.

The Hearing Power Must be Measured. For this various methods are used, the most useful being:

1. **The Watch.** It is useful to have two, one with a very loud and the other with an ordinary tick; both must have been carefully measured with normal hearing in order that each may have its standard. In testing with the watch (or in any other test) the eyes and the ear not under examination should be closed, and the watch having been placed close to the ear for the patient to appreciate what he is expected to hear, should then be taken to the extreme range and slowly approached until it is heard, the distance being measured by a tape measure.

Fig. 633.



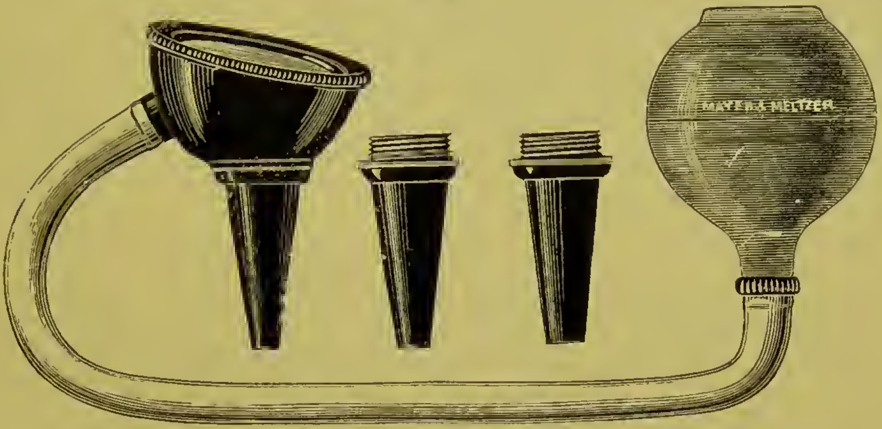
Acoumeter.

2. **The Voice.** The whisper and ordinary conversational voice and, if necessary, shouting should be used. This method is a useful but rough one, as it is almost impossible to gauge the voice accurately for each examination.

3. **The Acoumeter.** (Fig. 633.) This little instrument, invented by Politzer, is of great value, as the note struck is always of the same

value. It has a range of about forty feet in a quiet room. The mobility of the membrana tympani and malleus should be tested by using Siegle's pneumatic speculum (Fig. 634), with which the behavior of the membrane when the column of air in the meatus is exhausted or compressed can be examined.

FIG. 634.

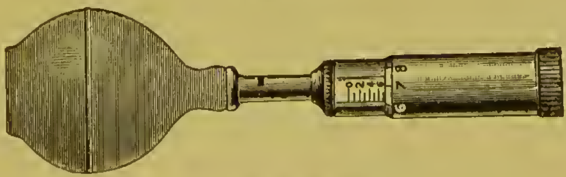


Siegle's pneumatic speculum.

The hearing power in these several ways having been tested it is necessary to establish the diagnosis of middle-ear from internal-ear disease. The history of the onset and cause of the deafness will aid considerably.

1. In middle-ear disease definite changes in the membrane are sometimes seen. Internal-ear disease is often marked by attacks of vertigo and vomiting, the special point regarding true labyrinthine vertigo being that objects appear to move in one direction or another. Vertigo is not found in uncomplicated middle-ear diseases. In middle-ear disease the deafness is markedly worse during a cold, in internal little or no increase is noted. Paracusis, or hearing better in a noise, is pathognomonic of middle-ear affections in their later stages; in internal the hearing is better in a quiet room, a noise confusing the patient. Roughly speaking, in middle-ear troubles low tones are badly heard, while the converse holds in internal; in comparing the hearing distance for the watch and voice this sign is often of value in the differential diagnosis. In order that this may be more accurately tested the following may be used:

FIG. 635.



The Galton whistle.

2. The Galton whistle (Fig. 635) is used for testing the upper limit of hearing and is only of value if the deafness is extreme. It

has a range from the highest appreciable pitch to near the medium. The whistle is made by compressing the rubber ball, the pitch being varied and measured by turning the cylinder.

A series of tuning-forks, such as Bezold's or Hartmann's, for testing the lower and middle ranges. Hartmann has a set of five forks: C, C + 1, C + 2c, C + 3, C + 4.

In middle-ear disease the deafness never becomes absolute as in internal. As a rule, the patient's own voice is heard loudly in middle, while in internal it may not be heard at all, so that if it is of long standing and bilateral the voice becomes monotonous; again if one ear is affected with internal-ear disease the voice will not be heard at all on that side, but will seem to travel over to the other.

On gently scraping the membrane in advanced internal-ear disease the action will be felt, but not heard. Inflation of the middle ear renders the hearing worse when the internal ear is affected.

In the normal ear air is better than bone conduction. In middle-ear disease the bone conduction is increased and is better than the aerial, while in internal bone conduction is diminished and the aerial is better than the bony.

These phenomena are tested in various ways by means of the tuning-fork, a C2 being the best to use for the purpose, as it is free from overtones.

1. **Schwabach's Test.** In this method the length of time the tuning fork is heard on the mastoid of the patient is compared with that of the observer, whose hearing must be normal.

If the tuning-fork is heard on the surgeon's mastoid after it has ceased to be heard on that of the patient it demonstrates that bone conduction is diminished and that internal-ear trouble exists, while if the patient can hear it after the surgeon, bone conduction is increased and indicates middle-ear disease.

The number of seconds of increase or diminution are counted and noted.

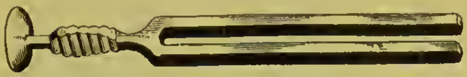
2. **Weber's Test.** In this test the vibrating tuning-fork is placed on the middle line of the skull, vertex, bridge of nose, or incisor teeth. If one ear is affected with middle-ear disease the sound will be heard principally in that ear, while if both are affected and one is markedly worse than the other, the sound will be heard better in that which is more affected. If the internal apparatus of one ear is affected the sound will be heard louder than in the normal, while if both are affected with internal-ear disease, and one is much worse than the other, the sound will be louder in the less affected ear.

If confusion should ever arise in the mind of the student in connection with this test, or, indeed, in any of the others, the clue can readily be found if the student closes one of his own ears with the finger, thus imitating middle-ear deafness, and, on placing the vibrating fork on the middle line of the cranium, finding that the sound is louder in the closed ear.

3. **Rinne's Test.** With this the air and bone conduction are compared. If, in the normal, when the fork has ceased to be heard in the mastoid, it be removed and the prongs are placed in the air close to the meatus the sound will be heard again, showing that the air is better than the bone conduction. This is called *positive Rinne*, and indicates either a normal ear or, if deafness is present, some affection of the internal ear, while if it be heard on the mastoid after it has ceased, when placed in the air close to the ear (*negative Rinne*) bone conduction is increased, thus indicating a middle-ear affection.

4. **Gardiner Brown's Test.** This test is based upon the fact that, given trained fingers, the vibration of a middle C tuning-fork placed on the mastoid in a normal case can be *felt* by the surgeon for precisely the same length of time as they can be *heard* by the person under observation.

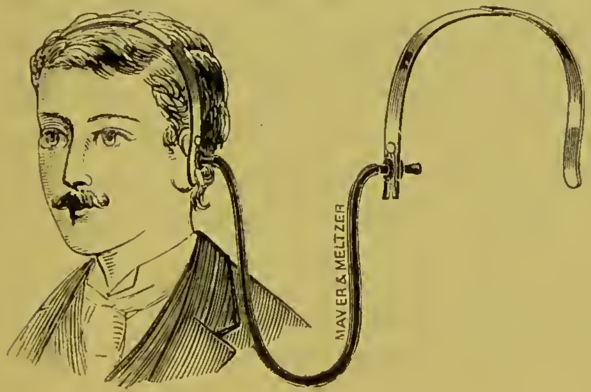
FIG. 636.



Gardiner Brown's tuning-fork; middle C, of 512 vibrations per second (one-third natural size).

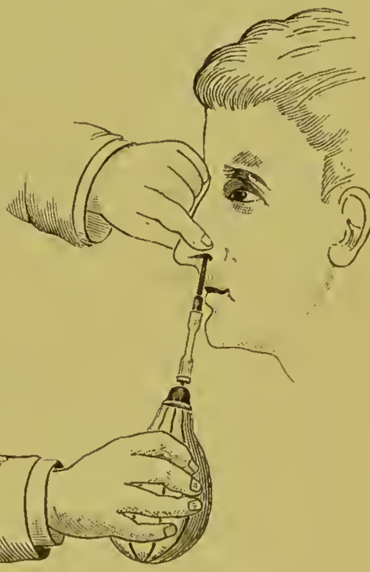
In the middle-ear affection the sound will be heard longer than the vibrations can be felt, while in internal the vibrations can be felt for a more or less period after the sound has ceased. This plus or minus should be counted in seconds and noted.

FIG. 637.



Auscultation diagnostic tube.

FIG. 638.



Politzer's method.

A diagnosis of middle-ear disease having been made the middle ear should be inflated through the Eustachian tube by means of Politzer's bag or a Eustachian catheter. During inflation a diagnostic tube should be used, passing from the patient's to the surgeon's ear, in order that it may be certain that the inflation is efficient, that any obstuction can be noted, or that fluid in the tube or middle ear can be diagnosed.

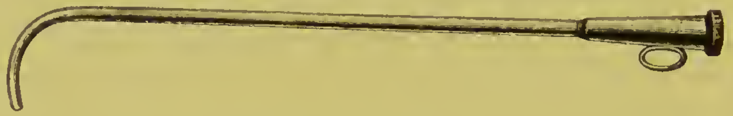
Politzer's Bag. The most useful is an eight-ounce one with Pritchard's nose-piece which is made of vulcanite and connected with the nozzle of the bag by means of a piece of india-rubber tubing.

The method of holding the bag is well shown in the accompanying cut. The bag is compressed while a sip of water is being swallowed, or when the cheeks are blown out, or on saying "hic;" all three methods, by elevating the soft palate and thus shutting off the nasopharynx from the pharynx, compel the air to enter the Eustachian tubes.

If one ear only is to be inflated by this method the patient's head should be turned on one side with the affected ear uppermost and, with the finger closing the sound ear, inflation should be practised through the nostril corresponding to the affected side.

Eustachian Catheter. The most useful catheter is a short silver one which can be boiled.

FIG. 639.



Eustachian catheter

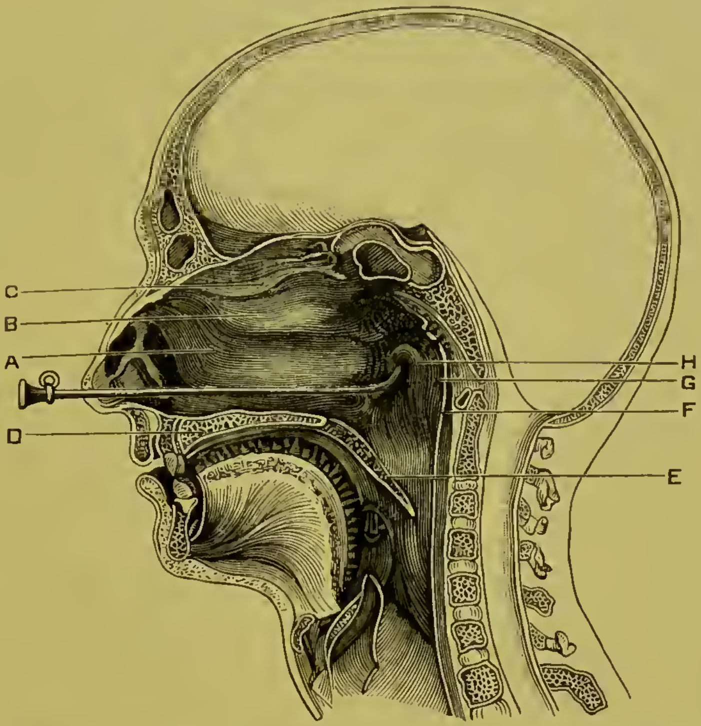
The most certain way of introducing it is Loewenberg's. After tilting up the point of the nose, the instrument with the point horizontal is passed over the elevation of the floor of the vestibule to reach the floor of the nose, the outer end is then brought up horizontally and the instrument passed lightly along to the posterior nasopharyngeal wall, when the beak is turned horizontally inward and gently withdrawn until the back of the septum is felt. The beak is then rotated downward, outward, and upward until the ring on the outer end, which corresponds to the beak, points to the outer canthus of the corresponding eye. Air is then blown through the catheter by means of a suitable bag.

If the tube is found to be much obstructed it may be necessary to introduce fluids or a *bougie* through the catheter.

Before introducing the latter accurate measurements must be made in the following way before passing the catheter. The bougie should be passed down the catheter until the point just appears at the inner or tube end; an ink mark is then made on the bougie at the point corresponding to the entrance of the outer end, and from this ink mark the length (34 to 36 mm.) of the Eustachian tube is measured off and again marked. In this way can be told (*a*) that the bougie is at the mouth of the Eustachian tube, (*b*) how far up the tube the bougie has passed, and (*c*) at which part of the tube obstruction is most marked. The passing of the bougie should be done gently and in a rotatory manner when passing through the tube. Lubricating the bougie with paroleine before introduction will be found useful.

After inflation has been effected the results on the membrane must be inspected and the hearing power again measured and noted. The effect on tinnitus, if present, should be inquired into.

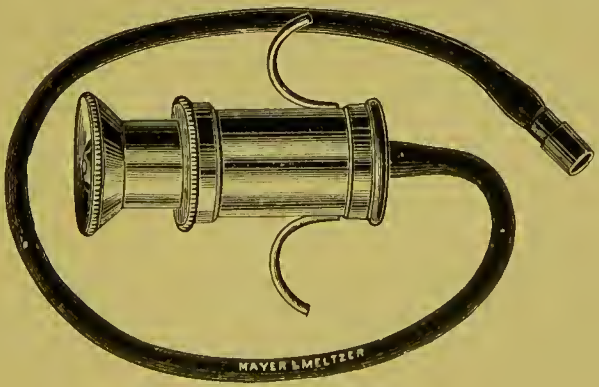
FIG. 640.



Vertical section of the nasopharynx, with the catheter introduced into the Eustachian tube. A. Inferior turbinated bone. B. Middle turbinated bone. C. Superior turbinated bone. D. Hard palate. E. Velum palati. F. Posterior pharyngeal wall. G. Rosenmüller's fossa. H. Posterior lip of the orifice of the Eustachian tube. (POLITZER.)

The effect of *massage* of the membrane by means of Siegle's speculum or Delstanche's masseur gently applied on hearing and tinnitus should be investigated.

FIG. 641.



Delstanche's masseur.

Massage may be applied under two conditions:

1. *With the meatal air exhausted*, when the membrane, malleus, and incus will be mostly affected.

2. *With the meatal air compressed*, when the stapes is thought to be reached.[1]

Classification. Difficulty is always experienced in classifying non-suppurated middle-ear diseases on a pathological basis, as, although great advance has been made of late years, the opportunity for investigation in their earlier stages is necessarily rare. The following must therefore be accepted tentatively and for purposes of description. Clinically, it is often difficult or impossible to draw hard-and-fast lines between them:

A. Hypertrophic catarrh.
  1. Chronic catarrh of the Eustachian tube.
  2. Chronic catarrh of the middle-ear tract.
B. Atrophic catarrh or sclerosis.
C. Changes in the lining membrane due to variations in pressure.
D. Changes in the lining membrane due to deficient blood supply.

A. **Hypertrophic Catarrh.** This is a disease which has its origin principally in early life, having for its chief characteristics deafness associated with definite changes in the membrana tympani, and some pathological conditions in the nose or nasopharynx.

Causation. The causes must be any condition which will

1. Predispose to attacks of acute catarrh.
2. Tend to make acute catarrh become chronic.
3. Maintain a chronic catarrh.

These causes may be local or general; the local condition above all others is chronic hypertrophy of the nasopharyngeal tonsil (adenoids), a disease chiefly of childhood and early life, although not uncommon in middle life, and occasionally met with at a much later period. Hypertrophied tonsils (although often associated with adenoids), if they are present alone, will help to maintain a chronic catarrh. Other local causes are secondary syphilis, true or false hypertrophy of the turbinal bodies, suppuration in accessory cavities of the nose, atrophic rhinitis, nasal polypi, irritation due to noxious fumes, tobacco, etc. The general causes are exposure to wet and cold, anæmia, tubercle, in fact any disease which lowers the vitality of the organism, rendering infection easy and hindering return to a normal condition.

Pathology. In considering the pathology of this disease we will consider shortly what a catarrh is and what changes are produced by it; but before doing so the reader may be reminded that the lining membrane of the middle ear consists of three layers:

1. Epithelial.
2. Subepithelial, containing lymphatics, nerves, and, comparatively speaking, large bloodvessels.
3. Fibrous, which is adherent to the bones.

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[1] Transactions of Otological Congress, 1899.

An acute catarrh is an acute inflammation of a mucous membrane due to either injury or infection. At present we are unable to say definitely what micro-organism will produce catarrh; but, as far as is known, any pathogenic organism has the power.

The immediate result of infection is acute swelling and reddening of the membrane, due to the engorgement of vessels and the presence of exudation, especially in the subepithelial layer. Exudation is also poured out from the surface, being serous, seromucoid, or chiefly mucoid. At this point resolution may take place, leaving no trace, the exudation in the subepithelial layers being carried off by the lymphatics, and the vessels returning to their normal size. But if, from some local or general cause, resolution does not occur, the engorgement of vessels continues, and more or less exudation persists, that which is poured out from the surface being a marked clinical feature in some cases.

The chronic engorgement of vessels leads to local proliferation, especially of the fibrous tissue in the subepithelial layer; this fibrous-tissue proliferation undergoes contraction, the exudation ceases, the epithelial layer by stretching becomes atrophied, and the whole lining membrane becomes ultimately converted into a layer of thick fibrous tissue.

There are, therefore, four stages which run one into another when the acute period is past:

1. Chronic engorgement of vessels with exudation.
2. Resulting proliferation, especially of the fibrous tissue.
3. Contraction of the proliferated fibrous tissue.
4. The ultimate stage of cicatricial condition which may be called postcatarrhal.

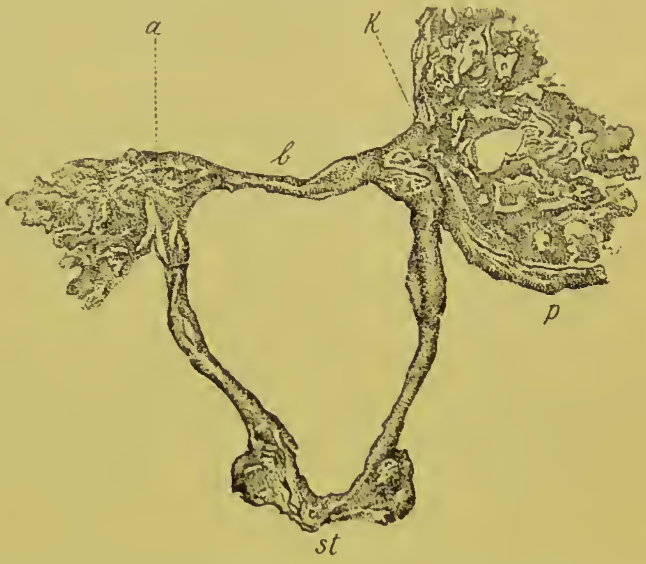
The results of such changes in the middle ear can be easily imagined when it is remembered that the lining membrane, besides clothing the bony walls and inner aspect of the membrane, forms folds and pockets around the ossicles, their joints, ligaments, and muscles.

At first the ossicles and membrana tympani are hampered by the swollen membrane and the exudation. Later the contraction of the proliferated fibrous tissue causes further and permanent fixation.

The membrana tympani is drawn in by the same cause, aided by the non-aeration of the cavity through the Eustachian tube, allowing external atmospheric pressure to exert its influence. The folds of lining membrane are converted into fibrous bands, binding down the ossicles to the neighboring walls, the incus to the outer attic wall, and the stapes to its niche.

The tip of the handle of the malleus coming in apposition to the promontory, the opposing epithelial layers become rubbed off, and allow of adhesion at this point. The ossicular joints become ankylosed, the muscles fixed. The exudation becomes inspissated or confined in pockets of the lining membrane. The Eustachian tube, sharing the same changes, becomes narrowed, so that an originally pink, moist, thin, somewhat movable, lining membrane becomes smooth, white, dry, and thick. Further changes of the lining membrane sometimes occur, such as calcification, fatty degeneration, etc. The tensor tympani and stapedius muscles undergo atrophic degeneration.

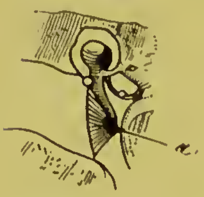
FIG. 642.



Ankylosis of the plate of the stapes with the fenestra ovalis. Microscopic section through the stapedio-vestibular connection. *st.* Head of the stapes. *b.* Base of the stapes. *p.* Promontory. *a.* Spurious adhesion of the border of the stapes with the fenestra ovalis. *k.* Adhesion of the anterior border, the edge being still noticeable by the dark line. (POLITZER.)

As the trouble may be limited to the Eustachian tube or may involve the whole middle-ear tract, each will be considered separately, with their symptoms, signs, prognosis, diagnosis, and treatment, as far as possible in their different stages.

FIG. 643.



Circumscribed adhesion of the membrana tympani to the promontory underneath the handle of the malleus. *a.* Place of adhesion on the promontory. (After a preparation of mine, now in the museum of the College of Physicians, in Philadelphia.) (POLITZER.)

a. **Chronic Eustachian Catarrh.** This may be limited to the orifice of the tube or extend some distance up the cartilaginous portion. If long continued, changes may take place in the whole tract; these will be considered under the changes produced by variations in pressure.

SYMPTOMS AND SIGNS. One or both ears may be affected; if both, one is often worse than the other. Deafness is marked, but may vary from time to time, improving sometimes on swallowing or on blowing the nose; but the improvement soon disappears, or, if permanent changes have not occurred, the patient, after suffering for some time, may feel a crack in the ears, with subsequent complete restoration of hearing.

On inflation with Politzer's bag or the Eustachian catheter immediate and permanent improvement may occur in the limited early stage, or, if the disease is of long standing, especially if it has extended some way along the tube, difficulty may be experienced in getting the tube open, and the resulting improvement, although great at the time, sooner or later disappears. On listening with the auscultation tube during inflation the air can be heard at first in the distance, entering with difficulty before clearly entering the cavity of the tympanum. In the exudation stage distant bubbling may be at first heard. The patient complains of a distinct feeling of oppression of the head on the side affected, and mental dulness may be felt, especially if both tubes are blocked. Tinnitus of a rushing character is heard. The patient's own voice sounds to him louder on the affected side, and if both ears are implicated it seems as if he were talking into a hollow vessel. The auricle and surrounding parts feel numb when lightly touched. On looking at the membrana tympani all the signs of depression will be seen. If permanent changes in the middle ear have not been produced the pink lining membrane may show through, unless any opacity be present. The white short process of the malleus is prominent, and the handle foreshortened and drawn somewhat backward. The folds running forward and backward from the short process to the periphery are marked, the latter especially. The triangular light reflection from the tip of the handle of the malleus is interrupted, shortened, or absent, depending upon the amount of depression. The structures in the middle ear and the inner wall may be clearly visible. In the posterior and superior segment the descending process of the incus, with the stapedius muscle running backward from close to its tip, and the chorda tympani nerve running from behind upward and forward across the descending process of the incus, may be seen. The smooth curve of the promontory in the inferior segment is well marked, and below and behind it the round window appears as a dark patch. On looking at the nasopharynx a catarrhal condition of the lining membrane may be seen, it being red and swollen, with exudation lying on its surface. Sometimes this can be seen involving the lips and orifice of the Eustachian tube, and rarely a plug of exudation may be seen lying in the orifice.

Prognosis. In the early stages this is very good; in the later it will depend on the amount of constriction produced and whether the tympanum is also involved.

Diagnosis. Simple chronic Eustachian catarrh will be diagnosed by the marked improvement of hearing, by inflation, and the absence of permanent changes in the membrane.

Treatment. Any causes in the nose or nasopharynx must be removed, and treatment directed to improving the patient's general condition adopted, especially change of air and tonics. In the early stages a single inflation may be all that is necessary to open a tube which has been perhaps blocked by a plug of mucus, or the sides of which have stuck together. If the trouble has extended some distance up the tube, inflation will have to be repeated, the intervals between the proceeding depending on the effect produced and the length of time improvement in hearing remains.

In the later stages, when contraction appears to become a definite feature, especially if the cartilaginous portion is affected, injections of alkaline solution or of paroleine, or the passage of a bougie through the Eustachian catheter may be necessary. Combined with this treatment the chloride of ammonium vapor, obtained by means of Godfrey's or Basdon's inhaler, drawn into the mouth and blown through the nose for ten minutes night and morning, with a few autoinflations into the middle ear by means of Valsalva's method, when the mouth and nose are full of vapor, is often of great use.

An alkaline and astringent solution gently syringed down the nose after the inhaler is often useful. In the last stage it will be usually found that further changes in the upper middle-ear tract have occurred either by extension of the catarrh or by changes produced by the variation in pressure. The treatment in these cases will be considered later.

A useful point when difficulty of opening the Eustachian tube by ordinary inflation is experienced, is to place a few drops of pure chloroform into the bag before inflation.

b. **Chronic Hypertrophic Catarrh in the Whole Middle-ear Tract. Symptoms and Signs.** These will depend on how far the disease has progressed.

1. **Stage of Chronic Engorgement of Vessels, with Exudation.** Although a certain amount of exudation from the surface is present in all cases, yet in some it forms a very prominent clinical feature demanding special description. It must be stated that cases of this variety are undoubtedly rare in Great Britain. It is impossible to say what determines this excess of exudation; undoubtedly in some cases the excess is more apparent than real, being due to the collection of exudation in the tympanum owing to coexisting Eustachian obstruction. The character of the exudation varies, being serous, seromucoid, or mucoid; and here also it is impossible to say definitely on what the varying characters of the exudation depends.

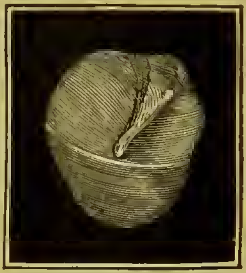
The history of these cases in which *exudation is marked* usually is that, after an acute catarrh of the nasopharynx, deafness in one or both ears persists. The exudation form may be present on the one side, with simple Eustachian obstruction on the other. There is a feeling of fulness in the ear, stopping short of actual pain, and a sensation of something moving, especially if the exudation is serous, with occasional bubbling, especially after blowing the nose. Improvement in hearing occurs temporarily, but is only of short duration, and may vary with the position of the head. The patient may hear bubbles bursting, especially after inflation. Rushing and occasional pulsating tinnitus is present. The head on the affected side feels heavy, and numbness of the auricle and surrounding parts is experienced. The patient's own voice sounds unusually loud. Inability to do mental work is often complained of, and sleep may be disturbed owing to the bubbling and cracking which goes on in the ear. When the mucoid element predominates bubbling on variations of posture are not marked.

Sometimes, especially in old people, the membrane may rupture on blowing the nose or on inflation, producing perhaps a suppurative process resulting from septic infection from the meatus. In infancy and early childhood rupture seems to readily take place in the early stages.

On examination the appearance of the membrane varies according to the character and amount of the exudation, to the length of time it has been present, and to the degree of clearness of the membrane.

If the exudation is slight and serous the malleal vessels are somewhat injected, and the fluid can be seen occupying the lower part, its upper level, which appears as a thin line, varying with the position of the head, or, if greater in amount, marked bulging, usually in the posterior segment, is seen, perhaps completely hiding the handle of the malleus. On inflation a disturbance of the fluid can be seen with the formation of bubbles, or if the auscultation tube be used, clear bubbling can be heard. If the mucoid element preponderates a whitish-yellow appearance of a more or less bulging membrane is seen with dilated vessels coursing over it; there is little or no movement observable on posture, and on inflation through the catheter, as the bag is often not effective, the air can be heard at first in the distance, and then to gradually enter the tympanum with sticky râles.

FIG. 644.



Accumulation of fluid effusion in the inferior portion of the tympanic cavity, marked by a bright line. (POLITZER.)

In the later period of the exudative stage the exudation partly escapes from the Eustachian tube, while some becomes inspissated, the membrane in the meanwhile becoming pale and depressed, with perhaps localized collections of exudation.

In those cases in which *exudation is not a marked* clinical feature the symptoms and signs are not so aggressive. Deafness, improving on blowing the nose, with gradual return to the former condition, and tinnitus of a rushing and pulsating character, are complained of. The membrane is somewhat depressed, the lining membrane seen through being dark pink in color. On inflation slight bubbling may be heard, the improvement in hearing produced being greater and more lasting than in the cases of marked exudation.

PROGNOSIS. This, if the case be properly taken in hand, is, as a rule, excellent; but if long continued or untreated, resulting in further changes in the lining membrane, as demonstrated chiefly by the amount of improvement in hearing produced by efficient inflation, renders it proportionately worse; therefore, before giving a definite opinion in long-standing cases, it is well to await the effect of treatment.

Diagnosis. The cases of marked exudation give definite signs. From a collection of pus they are diagnosed by the absence of acute redness of the membrane, chronicity, and the absence of pain and fever. If the exudation is mucoid a general whitish appearance is seen, instead of a yellow or greenish yellow, which is seen when the contents of the tympanum are purulent. The effect of treatment will also help. In those cases in which exudation is not a marked clinical feature bubbling is sometimes heard, and the unusually dark and swollen lining membrane seen through the membrana tympani, together with the persistency of the symptoms and effects of inflation, mark them from simple Eustachian obstruction.

Treatment. At this stage, as we have seen, it is possible for the disease to be completely arrested, and no means should be spared to prevent further progress. The treatment is local and general. Those cases in which *exudation* is marked will be first considered.

If this is slight and serous the treatment adopted for simple Eustachian catarrh will suffice. As before stated, it is impossible at first to say how much Eustachian obstruction is responsible for the collection of exudation in the tympanum; sometimes cases which at first appear to demand more radical measures yield to simple treatment. In the cases in which simple remedies do not effect a cure a collection of exudation persisting, and especially when the mucoid element predominates, they must be supplemented by intratympanic injections of warm sterile alkaline solutions, such as bicarbonate of soda, five grains to the ounce, or of paroleine. Counter-irritation behind the ear, or massage from above downward behind the ear and upper part of the neck, may also be used. If these measures do not suffice the membrane must be opened, perhaps more than once, as the incision speedily closes in spite of inflation. The incision must be made under strict antiseptic precautions through the part in which the bulging is most marked, or, if no bulging is present, in the posterior and inferior segment; it should be free and parallel to the handle of the malleus. At the time of incision inflation should be practised to clear the middle ear, the exudation being then gently mopped out. The meatus should then be lightly plugged with the antiseptic dressing. The simple treatment of the nose and nasopharynx with the chloride of ammonium inhaler and nasal solution should be continued meanwhile. Massage by means of Siegle's speculum will be found useful in hastening absorption and preventing adhesions. Change of air to a high and dry climate with tonics are especially beneficial.

In those cases in which *exudation is not marked* simple treatment, regular inflation, massage of the membrane, together with tonics and change of air, will usually be found sufficient. In these cases, again, local trouble in the nose or nasopharynx must also be removed.

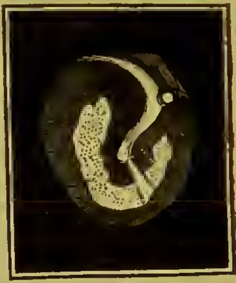
2. **Stages of Proliferation and Contraction.** In discussing the following stages, they merge so gradually one into the other that it is impossible to separate them completely, the progress of the cases being

judged according to the amount of improvement obtained by treatment and the changes present in the membrane. We may discuss the stages of proliferation and contraction together. This is a common period for patients to present themselves for treatment, as they find that the deafness, which they thought would pass off in time, has not only persisted, but is gradually getting worse.

Symptoms and Signs. The history of these patients, usually young adults, is that deafness has persisted after a cold or series of colds, or has gradually come on since, or that in childhood occasional deafness was noticed, with a history that points strongly to the fact that adenoids were present at that period. In fact, they often present the appearance due to chronic nasal obstruction. They also state that they are worse with every cold, with perhaps marked permanent deterioration. In the later stage, when far advanced, the symptom of hearing better in a noise may begin to show itself, indicating the gradual onset of the fixation stage. Deafness is well marked, both ears, as a rule, being affected, one, often the left, being the worse. The fact that the patient cannot hear general conversation, or, when at a dinner party, he cannot hear conversation distinctly on one side, may be the symptom which compels him to come for treatment. Tinnitus, rushing, roaring, clanging, or machinery-like in character, is often a source of great trouble, being worse when the patient is quiet, especially at night, sometimes preventing sleep.

Diplacusis, usually disharmonic, is sometimes complained of. On examination the membrane is pale, often opaque, with perhaps patches of chalky deposit (phosphate of lime), the signs of depression being marked, and in the latter stage the pink lining membrane cannot be seen, even if the drum is clear.

Fig. 645.



Horseshoe chalky deposit in the membrana tympani of a woman thirty years of age. Duration of the ear disease, ten years. Tinnitus seldom. Acoumeter = 30 cm. Speech = 3 m. (Politzer.)

On applying Siegle's speculum it will be found that the membrane and malleus do not move freely, or perhaps the posterior segment will alone be freely movable. On inflation through the catheter the air will be heard to enter with difficulty and dryly, with perhaps a whistling sound. The amount of improvement in hearing produced will vary according to how the pathological changes have progressed. On examining the membrane after inflation little or no alteration is seen. The nose or nasopharynx may present some pathological condition, and it is often possible to detect, even in middle life, remains of adenoids, which, if seen during a cold, may be considerable in size.

Prognosis. For this we rely upon the progressive character of the deafness, which is worse with each cold, and the absence of internal-ear trouble, as shown by the tuning-fork, etc. From the exudation stage, by the absence of moist sounds on inflation, the depression, fixation, and opacity of the membrane, and the amount of improvement produced by inflation. From the last stage, by the amount of improvement produced by inflation, the absence of paracusis, which, though present in the later stages of contraction, appears to indicate that the final stage is being reached.

Treatment. If, on inflation, the improvement in hearing is marked, we gather that the contraction stage has not advanced far, and we must adopt treatment which will, as much as possible, cut short the proliferation or limit the amount of contraction. In order to do this definite local troubles in the nasopharynx or nose must be removed, followed by regular inflation by means of the bag or Eustachian catheter, the intervals between the inflations being judged by the length of time improvement in hearing lasts. Massage by means of Siegle's speculum or Delstanche's masseur is also useful. The chloride of ammonium inhaler and the nasal solution, with tonics and change of air to a high and dry climate, should be combined with the other treatment.

If the Eustachian obstruction is a prominent feature a bougie may be passed up the tube, or paroleine may be injected through the catheter. If the results produced by this treatment are not great we must infer that contraction is well advanced, and we may have to consider, if the deafness is extreme, the question of operative treatment, which will be presently dealt with in considering the treatment of the postcatarrhal stage.

Sometimes iodide of potassium in small doses, combined with ammonia, given in hot water twice a day for a fortnight or three weeks, produces good results. With regard to tinnitus, the treatment we have indicated will usually do as much good as is possible, as it is mechanically produced, and depends on the local changes. Tonics are useful in rendering the patient more able to stand the noises; bromide of potassium and diluted hydrobromic acid are sometimes useful as sedatives. Electricity may be tried; if, at the first sitting, neither the anode nor cathode alters the sound the case is unfavorable; but if the noises are diminished during the passage of the anodal current the treatment is more hopeful, and should be continued.[1]

3. **Cicatricial or Postcatarrhal Stage.** This may be looked upon as the ultimate condition resulting from the unchecked progress of the disease, which may have occupied a longer or shorter length of time.

Symptoms and Signs. A history of gradual increasing deafness of catarrhal origin, distinctly worse on colds, until a pitch of deafness has arrived, which, although never absolute, necessitates a loud voice close to the ear. Paracusis Willisii, or hearing better in a noise, is a prominent symptom; this phenomenon is supposed to be due to vibration produced by jolting or loud noises, enabling the rigid ossicular chain to more readily transfer sound waves. Occasionally the patients will state that they *used* to hear better in a noise. Tinnitus is often very distressing, sometimes rendering life almost unbearable, and in a few even suicidal tendencies may be present. The patients are morose, introspective, being, to a large extent, cut off from the outside world. Many acquire in some degree the power of lip-reading, and they will consequently hear better when the speaker is facing them. A low but clear voice is heard better than shouting. High tones will be distinctly heard better than low; for instance, a watch will be heard comparatively better than the human voice. On looking at the membrane it will appear markedly depressed and opaque. By means of Siegle's speculum the malleus may be seen to be firmly adherent to the promontory, the membrane perhaps fixed to the descending process of the incus and around the malleus to the promontory. On inflation the air enters with difficulty, and produces no change in the position of the malleus or membrane. Improvement in hearing is either absent, or, if slight, is of short duration. Diminution of the noise is sometimes produced.

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[1] Lewis Jones, Archives of Otology, vol. xxiv.

PROGNOSIS is extremely bad as regards hearing and tinnitus; deafness is never absolute, and the patient may become more or less used to the noises, which may vary with the state of the health. Operative measures may produce improvement, if not in hearing, in tinnitus.

DIAGNOSIS. From the previous stages it may be diagnosed by the fixation of the membrane, the obstruction of the tube, the paracusis, and the slight improvement on inflation. The tuning-fork and tone-hearing tests will distinguish it from internal-ear disease; but we occasionally find that the tuning-fork in these cases indicates a certain amount of internal-ear implication; the history of paracusis will be sufficient to stamp the case as having originated in the middle ear, especially if other symptoms of internal-ear diseases are absent. True auditory vertigo does not occur.

TREATMENT. It follows from the pathological condition that ordinary local and general treatment is useless in effecting useful or any permanent improvement in hearing or tinnitus. The treatment, however, described under the previous stage should be given a fair trial. If the patient is satisfied with the temporary and slight improvement which may be effected, especially if lip-reading lessons are taken, ordinary methods of treatment should be from time to time employed.

Before undertaking operative measures care must be taken that the internal ear is intact, and it must be pointed out to the patient that they are more or less of an experimental nature. It is well to fully explain to the patient the true condition of things, and leave it to him to decide as to whether they should be undertaken. It is wise to first operate on the ear which is more affected. These operations fall under four headings:

1. Those undertaken to relieve tension.
2. Those undertaken to diminish undue flaccidity.
3. Those undertaken to allow sound-waves to reach the fenestræ direct.
4. Removal of some part of the bony labyrinthine wall.

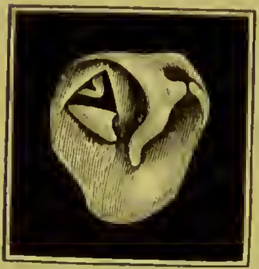
None of them should be undertaken without strict antiseptic precautions.

1. *Those Undertaken to Relieve Tension.* These comprise division of adhesions, section through the posterior fold, tenotomy of the tensor tympani, and division of ligaments. These have not realized expectations, any improvement which is produçed speedily disappearing as soon as the inevitable healing takes place; therefore they may be placed on one side.

2. *Those Undertaken in Cases of Undue Flaccidity.* When the membrane or some part of the membrane is seen by inflation or the Siegle speculum to be unduly flaccid, due to atrophy or too energetic inflations, or the result of a cicatrix, especially if marked improvement in hearing occurs when it is put on the stretch, multiple incisions made through the flaccid part with the idea of producing cicatricial contraction may be undertaken; but the result is often disappointing. Collodion painted over the flaccid portion and adjacent meatal wall may be of benefit.

3. *Those Undertaken to Allow of Sound Waves Reaching the Fenestræ Direct.* It has long been known that the artificial perforation of the membrane will, in some cases, produce great improvement in hearing; but, as healing always takes place, and no method of keeping the perforation open has yet been devised, some further procedure becomes necessary. As to whether further proceedings should be adopted, exploratory tympanotomy is a useful guide, for if it produces improvement in hearing or tinnitus, we are encouraged to proceed to more radical measures; but, even if it does not, and given that the internal ear is intact, and the case is not one of atrophy, we may, if the patient so desires, adopt the more radical measures, as it may mean that the absence of improvement is due to fixation of the stapes, or the blocking of the round window to a cicatricial tissue.

FIG. 646.



Triangular incision in the posterior-superior quadrant for exposing the articulation of the incus and stapes. (POLITZER.)

Exploratory Tympanotomy. This little operation is best performed under gas anæsthesia by cutting a flap with its apex uppermost in the posterior and superior segment, by means of a sharp-pointed knife under a good reflected light. Preliminary inflation of the middle ear may be useful in separating the membrane as far as possible from the middle-ear wall. Further procedures can be divided into two stages:

a. Removal of the membrane, malleus, and incus, which, if not productive of improvement, even after an artificial membrane has been tried, may be followed by

b. Mobilization or removal of the stapes and removal of cicatricial tissue from over the round window.

a. The Removal of the Membrane, Malleus, and Incus. This should be performed under a general anæsthetic, the head being slightly raised on a pillow and turned three-quarters over to the opposite side. A good reflected light is necessary. An incision is made with a sharp-pointed knife, starting from immediately behind the short process of the malleus, sweeping around as close to the periphery as possible to a corresponding point on the anterior aspect of the short process. The handle is then freed from adhesions which may be present between the membrane or malleus and the promontory. The tensor tympani is then divided, either by Delstanche's extractor or by a small curved knife. The malleus is then seized as high up as possible with a pair of strong curved forceps, being pulled first downward to free it from the attic, and then outward. The incus must then be turned out from the attic by means of an incus hook, which, being introduced into the interior part of the cavity, is rotated downward and backward, pushing the ossicle into the lower middle ear, when it may be removed by forceps or by syringing. Numerous incus hooks are made, the most useful being either Delstanche's, Lake's, or Ludwig's.

Fig. 647.

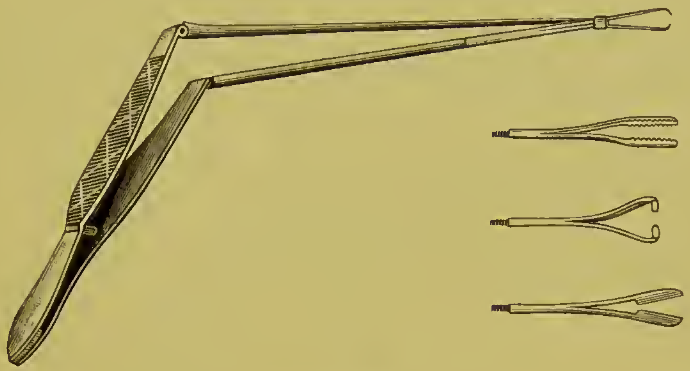
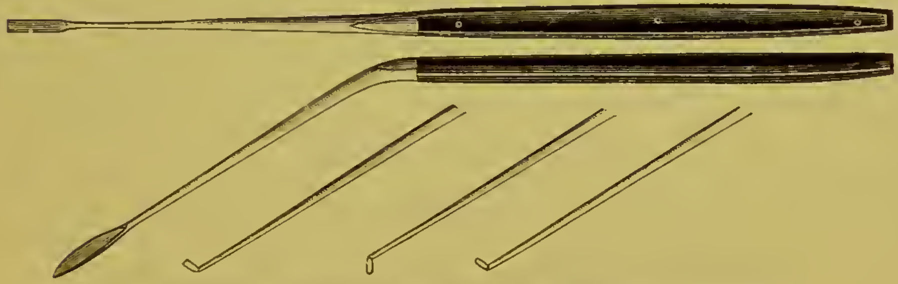


Fig. 648.

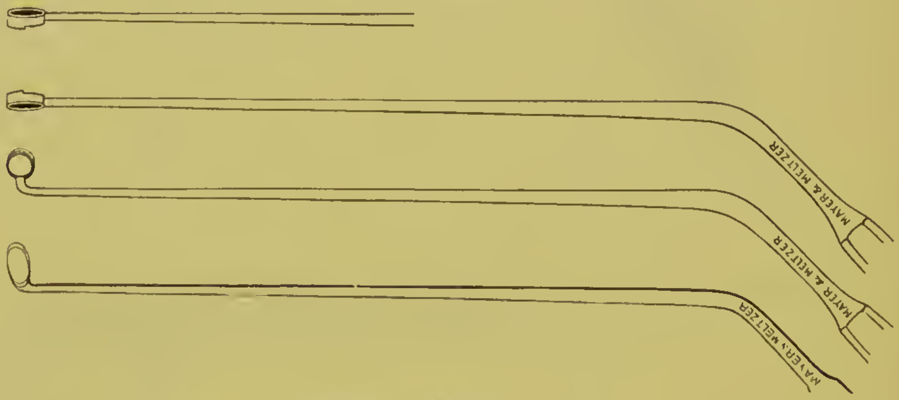


Sexton's forceps and knives for removing the membrane and ossicles.

The middle ear should then be gently mopped out, a gauze dressing should be lightly introduced into the meatus, and a general dressing and bandage applied. If antiseptic precautions have been efficient dressing will not be required for a week or ten days. At the end of a fortnight or three weeks the hearing power should be tested again and the amount of tinnitus noted. The dressing should not be left out until healing is complete, when an artificial membrane may be tried if no improvement results. Sometimes an adventitious membrane forms across, annulling any good effect, and may require removal more than once.

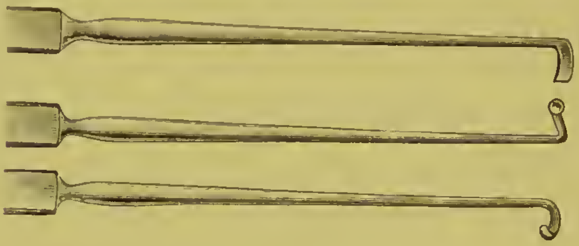
b. Mobilization and the Removal of the Stapes and the Removal of Cicatricial Tissue from over the Round Window. Before these operations are performed the ear should be allowed to heal soundly, allowing the condition of the inner middle wall to be plainly seen. Adhesions binding down the head and crura of the stapes should be divided with a fine, sharp, shouldered knife, such as Politzer's, as close to the ossicle as possible under eucaine or cocaine, the stapedius muscle being also divided and the stapes mobilized by means of a suitable probe. If improvement occurs nothing more should be done; if it does not, we may again try an artificial membrane; if this is ineffective we should remove adhesions obscuring the round window as far as possible, a rather difficult procedure, on account of the anatomy of the part. If this is insufficient we must infer fixation of the base of the stapes.

Fig. 649.



Delstanche's malleus extractor

Fig. 650.



Lake's attic curette and incus hook.

With regard to removal of the stapes more experience and investigation are necessary.

If mobilization has not been possible attempted removal will, in all probability, result in fracture of the crura, leaving the foot-plate still in position. The attempted removal should be made by means of a fine hook introduced between the crura from above, and with a gentle side-to-side movement. It may be that, in the future, operations on the inner middle-ear wall may be of benefit. A more radical method has been proposed and carried out by Malherbe,[1] who opens the antrum from behind, divides the adhesions in the middle ear, and introduces a celluloid tube through the meatus into the antrum. The results have not been brilliant, and until further experience has been obtained it may be fairly stated that operations through the meatus, as described, are equally efficient.

4. *Removal of Some Part of the Bony Labyrinthine Wall.* Mr. Charles Ballance brought forward a case at the Otological Society of the United Kingdom[2] in which, in the course of operating for suppurative extension from the middle ear, he found it necessary to open the vestibule from behind. After the subsequent skin grafting the hearing, which had been lost, returned in a surprising degree, and the giddiness and staggering which had been extreme, totally disappeared. Following this case Milligan and Ballance have operated on non-suppurative middle-ear disease in the latest stage[3] by—after opening the antrum and laying it open into the middle ear, as in the complete mastoid operation—removing a portion of the promontory and immediately applying a skin graft. The results in some cases were somewhat encouraging, especially as regards tinnitus; but a verdict cannot at present be given.

B. **Atrophic Catarrh. Fixation of Stapes.** The chief characteristics of this form are the very gradual and insidious onset of the deafness, with little or no change in the membrane, and no obvious cause in the nose or nasopharynx, the majority of cases occurring in women between the ages of twenty and forty years.

Causation. The causes are obscure in the highest degree. Heredity is certainly an important factor. Occasionally a vague history of a bad cold or series of colds is obtained as a starting point. Some severe illness, such as rheumatic fever, is thought sometimes by the patient to be the origin, and occasionally chronic rheumatic affections are coexistent. Anæmia is often present. Parturition is intimately connected with this class, the deafness either apparently commencing after labor, or being made considerably and permanently worse thereby.

Pathology. This appears to be an atrophy of the lining membrane, with a marked tendency to the fixation of the base of the stapes in the oval window, and sometimes implication of the internal ear in the later stages. The onset is so gradual that pathological investigation in the early stages is wellnigh an impossibility; we are only familiar with the ultimate results produced. On removing the roof of the middle ear affected with the disease the first thing that strikes one is the wideness, whiteness, and dryness of the whole cavity, the contained structures being clearly defined. Fine membranous septa in various parts can be seen, and are apparently the atrophied remains of the folds of the lining membrane. A well-marked membrane is sometimes seen running up from the tendon of the tensor tympani to the roof.

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[1] Proceedings of the Sixth International Congress of Otology, 1899.

[2] Transactions, 1899–1900, vol. i.

[3] Milligan. Transactions of Otological Society, 1899–1900, vol. i.

On microscopic examination the layers are atrophied and the distinctive characteristics cannot be made out. The base of the stapes is fixed to the oval window, either by calcification or ossification of the ligamentous ring, or by deposit of new-formed osseous substance upon the inner surface of the foot-plate, and a complete bony union of the wall of the oval window may exist (Politzer).

The condition is thought by some to be due to a trophic lesion, as, especially in the later stages, little or no injection of the malleal vessels takes place on efficient inflation; but this may be due to the fact that the vessels share in the atrophic process, or are constricted. The fact that ganglion cells are found in the lining membrane suggests that some change in them may possibly interfere with nutrition. Trophic causes, however, will not account for bony ankylosis of the base of the stapes, a condition which points to some irritative periosteal cause, perhaps irritation due to some chemical cause. Thoma, in his work on pathology, describes an atrophic catarrh in which the mucous membrane becomes thinner and atrophied, and it must be allowed that such a process will most readily account for the condition found.

With regard to the secondary affection of the labyrinth, impairment of function may result simply from disease; but in some cases, at all events, further changes must exist. It may be that the atrophic process is continued to the cavity of the labyrinth, with resulting decrease of secretion of the intralabyrinthine fluids, the perilymph in particular.

Some cases with symptoms closely resembling those seen in this group have been found by Toynbee, Politzer, Bezold, and others to be due to a primary affection of the labyrinthine bony capsule, producing ankylosis of the base of the stapes, without any pathological lesion of the lining membrane.

Symptoms and Signs. The onset of the symptoms is so insidious that, as a rule, the patient does not come for treatment until the disease is well advanced. In some a slight hissing tinnitus was present for some time before the deafness was noticed, a gradual decrease of hearing in one ear, usually the left, being unnoticed or disregarded until the other ear becomes seriously affected; both ears then gradually becoming worse. In other cases the patient's friends are the first to notice the diminution in function. The tinnitus is often not distressing, the patient getting absolutely used to it; in others it is one of the most prominent features. When the disease has advanced considerably in both ears paracusis is a marked symptom. The hearing is usually worse during a cold. Occasionally the disease appears to stop short, or to progress very slowly, when the later stages are reached, and complete stone deafness is never observed. On inflation a very slight improvement in hearing is produced, but soon disappears, and, as before mentioned, little or no resulting injection of the malleal vessels can be seen. In some the inflation may not be felt in the ear, although the diagnostic tube clearly indicates that it has been successful. Attacks of true auditory vertigo are not experienced. The Eustachian tube shows no signs of obstruction, but, on the contrary, seems unusually patent, the air entering very clearly and dryly. On examination the meatus is usually clear of cerumen; in fact, patients sometimes complain that their ears seem dry. On looking at the membrane the absence of gross changes is very marked; it often looks unusually bright, clear, and thin, with little or no signs of depression. The membrane and malleus move freely with Siegle's speculum. The nose and nasopharynx in the majority of cases appear perfectly normal; sometimes the nose may appear dry, the patient stating that a handkerchief is not often necessary, and the lining membrane of the nasopharynx may appear thin, the lips of the Eustachian tube standing out boldly; but it is never dry and glazed. There appears to be no connection, as one would expect, between so-called atrophic rhinitis and this disease. Paleness of the soft palate with a blush on each side is usually present (Urban Pritchard).

Prognosis. This is always extremely bad; no treatment has any power, apparently, to check its progress; the deafness goes from bad to worse, but may stop short at some point, absolute deafness never resulting, the patient being always able to hear something.

Diagnosis. The age and sex of the patient, the insidious onset, the appearance of the membrane, the absence of Eustachian obstruction, freedom and dryness of air-entry on inflation, the slight improvement produced thereby, and absence of any cause in the nose or nasopharynx separate this from other middle-ear diseases. The tuning-fork, etc., will distinguish it from internal, and in those cases in which internal-ear results are produced by the tuning-fork the presence of paracusis will give the clue. In cases of primary disease of the labyrinthine capsule the pink lining membrane can be seen through the membrana tympani.

Treatment. As before stated, we have as yet no treatment which has any power to check the disease when once it has started; it remains to be seen whether operations on the labyrinthine bony capsule are of real and permanent value.

The general health of the patient must be put in the best possible condition. The local treatment is merely palliative, and even this must be used with extreme caution, or the patient will be made distinctly worse. Occasional catheterization, with injection of paroleine or inflation with the bag, especially if a few drops of chloroform be previously introduced, produces a slight amount of improvement, and is a comfort to the patient. The chloride of ammonium inhaler produces little or no benefit, except that a tendency to colds is held in check.

Massage with Siegle's speculum in the ordinary way must be very cautiously and gently applied, as in the great majority of cases it is distinctly detrimental. Too prolonged application of inflation or massage will produce undue flaccidity of the membrane, and so add to the trouble.

At the Sixth International Congress of Otology, in 1899, Mink stated that he had produced good effects by using Siegle's speculum in a modified way. The membrane and malleus are first compressed by air, stopping short of pain, before massage is applied; this method, which aims at moving the base of the stapes, has not received a fair trial.

With regard to operative intratympanic measures the general experience is that they are contradicted; but perhaps it is only fair to say that those on the stapes and inner middle-ear wall are still on their trial. With regard to artificial aids in the extreme stage, lip-reading lessons are of great value, and may entirely alter the patient's outlook on life. Mechanical aids are mainly useful for individual conversation; when obtaining one, all varieties should be tried; as a rule, the ordinary speaking-tube will be of the greatest service.

C. **Changes Produced by Variations in Pressure.** **Negative Pressure in the Tympanum.** Concerning this little is known; but the adoption of a separate class for it is warranted by the deafness which occurs in those who work under increased atmospheric pressure, such as deep-sea divers, and in those cases in which deafness results as a result of chronic mechanical obstruction of the tube, such as cicatricial contraction, pressure of tumors, etc.

It may be stated, however, that it is difficult to exclude the previous forms of disease in these cases; but, on the other hand, some of the changes described as having resulted from a chronic catarrh may be due to a long-continued negative pressure.

Causation. These are of two varieties:

a. Long-continued or often-repeated increase of atmospheric pressure on the membrane.

b. Non-aeration of the middle ear, owing to:

1. Mechanical occlusion of the tube by cicatricial contraction, pressure of tumors, etc.

2. Nasal obstruction due to any cause, especially when affecting the inferior meatus, as this place is practically a continuation of the mouth of the Eustachian tube.

3. Paresis of the Eustachian muscles, as occurs sometimes after diphtheria, preventing, by their inaction, proper aeration.

Pathology. Of this we have nothing but conjecture to go upon; but it can readily be conceived that if air is prevented from entering the middle ear by the atmospheric pressure from without, or by obstruction from within, a long-continued or often repeated negative pressure in the tympanum will produce a chronic dilatation of the vessels of the lining membrane, with resulting hypertrophy of the tissues and fixation of the ossicular chain.

Symptoms and Signs. Those of the hypertrophic class, plus the obvious cause which exists apart from catarrhal conditions.

Prognosis. This will depend, firstly, whether the cause can be removed; and, secondly, if removal is possible, on the results obtained by subsequent aeration of the tympanum.

Diagnosis. As far as can be judged at present this depends on middle-ear symptoms and signs combined with an obvious cause of non-aeration apart from catarrh.

Treatment. In those working under increased pressure care must be taken that there is no hindrance to the entry of air through the tube. In those cases in which non-aeration is due to obstruction in the nose or nasopharynx, removal of the cause, if possible, is indicated, with subsequent aeration of the tympanum. With regard to the removal of septal spurs or hypertrophied turbinals, a good rule to observe is that they should not be interfered with unless marked blocking of the inferior meatus is present, or if the passage of the Eustachian catheter is interfered with. When once the obstruction is removed and subsequent aeration fails to produce improvement, the question of intratympanic operations directed to removing the rigid ossicular chain may be considered.

D. **Changes Produced by Deficient Blood Supply.** Of this form little definite is known, but cases are met with in the later periods of life when the clinical features—local and general—suggest that the impairment of hearing may be primarily dependent on interference with the sound-conducting apparatus due to defective nutrition of the soft structures of the middle ear. The subjective symptoms are a gradual deterioration of hearing power without tinnitus, one ear being usually more affected than the other, and varying with the general health and condition of the patient. On objective examination the membrane may be normal, but sometimes looks thinner and clearer than usual. On inflation the Eustachian tube is patent, but very slight if any improvement results, the injection of the malleal vessels after inflation being also slight. With the Siegle speculum the membrane and malleus often move well, but as a rule with no good effect. When tested with the tuning-fork it will be found that the internal ear is also impaired; in some the internal-ear impairment seems to predominate. Paracusis and true auditory vertigo do not occur. (In some cases Gardiner Brown's test gives a normal result, owing to the equal impairment of both middle and internal ears; this sign, first pointed out by Urban Pritchard, is of great value.) With regard to the diagnosis of this condition it must be admitted that it is usually difficult, even in the presence of marked evidence of general arterial disease, to clearly separate these cases from those of senile nerve deafness. The treatment in these cases is general; no local treatment is of any service.

INDEX.

- ABDUCENS paresis, 179
- Abduction, normal, degree of, 154
  - testing power of, 160
- Aberration, chromatic, 65
  - increase of, with increase of size of object, 65
  - spherical, 65
- Abscess of brain, in mastoiditis, 1121
    - relation of, to diseases of the eye, 634
  - cerebellar, in middle ear, 1121
    - otic, 1173
      - diagnosis of, differential, 1174
      - symptoms of, 1173
      - treatment of, 1174
  - cerebral, in middle-ear disease, 1120
    - otic, 1169
      - diagnosis of, 1171
      - etiology of, 1169
      - symptoms of, 1169
      - treatment of, 1171
  - of conjunctiva, 286
  - of cornea, 305
  - of eyelid, 240
  - of middle ear, extradural, 1119
  - peritonsillar, 993
  - pharyngeal, 697
  - retropharyngeal, 1017
  - subdural, 1161
    - symptoms of, 1161
    - treatment of, operative, 1162
  - tonsillar, 696, 993
- Accessory sinuses, diseases of, 922
- Accommodation, 67, 77
  - amplitude of, 69
  - in astigmatism, 103
  - in hyperopia, 93
  - measurement of, 69
  - mechanism of, 67
    - Helmholtz's theory, 67
    - Tscherning's theory, 68
  - spasm of, 84, 183
  - variation of, with age, 69
- Accommodation-convergence, 152
- Accommodative asthenopia, 109
  - effort as a factor in the causation of glaucoma, 541
  - myopia, 84
  - power, estimation of, by means of test-letters, 73
- Acid caustics, 750
- Acne of the conjunctiva, 292
- Acne rosacea, relation of, to diseases of the eye, 630
- Acromegaly, relation of, to diseases of the eye, 649
- Adams' operation for ectropion, 254
- Addison's disease, relation of, to diseases of the eye, 585
- Adduction, normal, degree of, 154
  - testing power of, 159
- Adenocarcinoma of nose, pathology of, 718
  - of throat, pathology of, 718
- Adenoid tuberculosis, 701
  - vegetations, 1023
    - diagnosis of, 1026
    - etiology of, 1023
    - prognosis of, 1027
    - symptoms of, 1023
    - treatment of, 1028
      - operation in, 1029
      - technique of operation in, 1029
- Adenoma of caruncle, 293
  - of conjunctiva, 291
  - intranasal, 890
  - of larynx, 720
  - of nose, pathology of, 720
  - papillare, 888
    - diagnosis of, 888
    - prognosis of, 888
    - symptoms of, 888
    - treatment of, 888
  - of soft palate, 989
  - of throat, pathology of, 720
- After-cataract, 485, 497, 521
- Albinism, 371
  - treatment of, 371
- Albino, ophthalmoscopic representation of an eye-ground of an, 52
- Albinotic fundus, 340
- Albuminuria, relation of, to diseases of the eye, 598
- Albuminuric retinitis, 423 425
- Alcoholism, relation of, to diseases of the eye, 606
- Alderton's pus basin, 1136
- Allport's ear forceps, 1143
- Alopecia of the eyebrows and eyelashes, 631
- Alternating convergent strabismus, 174
- Amaurosis, infantile, 440
  - uræmic, 424
- Amblyopia ex anopsia, 172, 573

Amblyopia, congenital, 574
  diabetic, 458
  from disuse, 573
  glycosuric, 577
  from hemorrhage, 578
  hysterical, 574
  from lightning flash, 578
  malarial, 577
  quinine, 461
  reflex, 579
  simulated, 574
  uræmic, 577
Ametropia, correction of, 80
  diffusion images in, 77, 78
  vision in, 77
Amnesia, visual, 471
Amyl alcohol as a cause of blindness, 606
Amyloid disease of the conjunctiva, 284
Anæmia of nose, 689
  relation of, to diseases of the eye, 583
Anæsthesia of cornea, 529
  of larynx, 1046
  of nose, 1040
  of pharynx, 1043
    etiology of, 1043
    symptoms of, 1043
    treatment of, 1043
Anagnostaki's and Hotz's operation for trichiasis, 252
Anaphoria, 176
Anatropia, 176
Anel's lacrymal syringe, 220
Aneurism by anastomosis, orbital, 204
  relation of, to diseases of the eye, 636
Angina epiglottidea, 813
  Ludwig's, 1013
  membranous (non-diphtherial), 995
    diagnosis of, 995
      differential, 996
    etiology of, 995
    symptoms of, 995
    treatment of, 996
Angioma of conjunctiva, 259
  of eyelids, 244
  intranasal, 888. (*See* Intranasal Angioma.)
  of larynx, 902
  of nose, pathology of, 721
  of orbit, 204
  of soft palate, 989
  of throat, pathology of, 721
  of uvula, 989
Angioneurosis, 690
Angle alpha, 153
  gamma, 153
  metre, 152
  visual, 71
Aniridia, 348
  congenital, glaucoma following, 552
Anisocoria, 31
Anisometropia, 108
  prescribing glasses for, 132
Ankyloblepharon, 255
Annular posterior synechiæ, 350
Anosmia, 1038
Anosmia, etiology of, 1038
  symptoms of, 1039
  prognosis of, 1039
  treatment of, 1039
Anosphresia, 1038
  etiology of, 1038
  prognosis of, 1039
  symptoms of, 1039
  treatment of, 1039
Anterior chamber, 339
    changes in the, in primary glaucoma, 530
    exudation into, 349, 351
    glaucoma following epithelial cysts in the, 551
    hemorrhage into, 362
Anthrax of the eyelid, 240
Antitoxin, dangers of, in treatment of diphtheria, 835
Antrum, cysts of, 979. (*See* Mucocele.)
  dropsy of, 979. (*See* Mucocele.)
  of Highmore, 923
    development of, 926
Aphakia, 477, 523
Aphakic eye, 59
Aqueous humor, 345
    changes in the, in primary glaucoma, 533
Arcus senilis corneæ, 317
Argyll-Robertson operation for ectropion, 254
  pupil, 32
Argyria conjunctivæ, 288
Argyrosis, 288
Arlt's method of blepharoplasty, 245, 246
  operation for ectropion, 254, 255
Arteria centralis retinæ, 333
Arteries, ascending pharyngeal, 1008
      anomalies in distribution of, 1008
Artificial eyes, 416
Asch operation, 759
Asmus, sideroscope of, 405
Asteroid hyalitis, 385
Asthenopia, 109
  accommodative, 109
  cephalalgia, 109
  dolens, 109
  irritans, 109
  muscular, 109
  panorama, 109
  retinal, 109
  simplex, 109
  tarsal, 109
Asthma, 808
  etiology of, 808
  pathology of, 808
  treatment of, 809
Astigmatic clock-face, use of, in determining refraction, 125
Astigmatism, 76
  absolute refractive state in, 99, 100
  accommodation in, 103
  compound hyperopic, 100
  correction of, 103, 107
  determination of, by skiascopy, 122

- Astigmatism, determination of corneal curvature in, by keratometry, 114
  - development of, 98
  - diffusion images in, 100, 101
  - direct, 97
  - etiology of, 98
  - idiopathic, 98
  - images of a line formed in, 102
  - inverse, 97
  - irregular, 97
    - determination of, by skiascopy, 123
  - meridianal aberration in, 97
  - oblique, 97
  - pathological, 98, 99
  - physiological, 98
  - prescribing glasses for, 131
  - primary, 98
  - regular, 97
  - against the rule, 97
  - with the rule, 97
  - secondary, 98, 99
  - simple hyperopic, 100
    - myopic, 101
  - symptoms of refractive errors in, 110
  - vision in, 101
- Atrophic catarrh of middle ear, 1195
    - causation of, 1195
    - diagnosis of, 1197
    - pathology of, 1195
    - prognosis of, 1197
    - symptoms of, 1196
    - treatment of, 1197
  - nasopharyngitis, 1022
  - pharyngitis, 1012
    - symptoms of, 1012
    - treatment of, 1012
  - rhinitis, 716, 789
    - diagnosis of, 795
    - etiology of, 790
    - prognosis of, 795
    - symptoms of, 792
    - treatment of, 795
- Atrophy, chronic inflammation with tendency to, 716
  - of conjunctiva, 285
  - of eyeball, 379
  - faucial, of lymph tissue, 726
    - pathology of, 726
  - of lymphoid tissue, 725
  - of nose, 716
    - forms of, 716
  - of retina, 422
  - of throat, 716
    - forms of, 716
- Atropine, use of, as a cycloplegic, 112
- Atropine-poisoning, relation of, to diseases of the eye, 285, 607
- Auditory meatus, external, diseases of, 1086
    - inflammation of, circumscribed, 1089
      - diagnosis of, 1089
      - etiology of, 1089
      - symptoms of, 1089
      - treatment of, 1089
- Auditory meatus, inflammation of, diffuse, 1090
    - etiology of, 1090
    - symptoms of, 1090
    - treatment of, 1091
  - nerve, diseases of, 1105
  - neuroses, 1102
- Auricle, frost-bite of, 1085
  - syphilitic affections of, 1082
  - wounds and injuries of, 1084
    - description of, 1084
    - treatment of, 1084, 1085
- Axial hyperopia, 95
  - myopia, 84, 85

- BACON'S cupping-glass, 1090
  - ear syringe, 1088
- Bacteria, staining for, in sections of the eyeball, 680
- Bandolet keratitis, 316
- Basedow's disease, 208
    - relation of, to diseases of the eye, 589
- Biconcave lenses, 61
- Biconvex lenses, 61
- Binocular field of fixation, limits of, 156
  - vision, 74
- "Black eye," 256
- Blake's middle-ear syringe, 1139
  - polypus snare, 1135
- Blennorrhœa, acute, of conjunctiva, 270
- Blepharitis, 241
  - pediculosa, 242
- Blepharoplasty, 244
  - Arlt's method, 245, 246
  - Dieffenbach's method, 246
  - Fricke's method, 245
  - Knapp's method, 245, 247
  - Wolfe's method, 246
- Blepharospasm, 234
  - treatment of, 234
- Blindness, color, 568
  - day, 580
  - night, 580
  - snow, 581
- "Blinking," 234
- Blood supply to middle ear, deficient, 1199
    - changes produced by, 1199
    - diagnosis of, 1199
    - symptoms and signs of, 1199
    - treatment of, 1199
- Bosworth's nasal saw, 757
  - snare, 764
  - speculum, 731
- Boucheron's speculum, 1078
- Bowman's membrane, 295
  - operation of slitting the canaliculus, 221
  - probes, 219, 224
    - method of inserting, 222
    - in position, 223
- Brain, abscess of, in mastoiditis, 1121
    - relation of, to diseases of the eye, 634

Brain, diseases of, effect of, upon the eye, 631, 634
  injuries of, effect of, upon the eye, 650
Brandegee's forceps, 1030
Bromism, relation of, to diseases of the eye, 606
Bronchial tubes, relation of diseases of, to diseases of the eye, 595
Brown's (Moreau) laryngeal syringe, 913
Buck's blunt curette, 1079
  glass pipette, 1139
Bulbar paralysis, relation of, to diseases of the eye, 645
Bullous keratitis, 310
Buphthalmos, 321
  primary, 553
Butts' tonsillar hæmostat, 1002

CANAL, hyaloid, 344, 345
  of Petit, 476
  Schlemm's, 325, 339, 344, 345
Canaliculi, 214
  stenosis of, 219
Canaliculus knife, Weber's, 222
Canthoplasty, 238
Canthotomy, 238
Capsular cataract, 485
  opacities, 497, 503
Capsule forceps, 508
  Tenon's, 149
Carbon-dioxide poisoning, relation of, to diseases of the eye, 460, 606
Carbuncle of eyelid, 240
Carcinoma, intranasal, 892
    diagnosis of, 893
    forms of, 893
    pathology of, 893
    symptoms of, 893
  of larynx, 904
    diagnosis of, 905
      differential, 905
    etiology of, 904
    pathology of, 904
    prognosis of, 906
    symptoms of, 905
    treatment of, 906
  of nasopharynx, 1035
  of nose, pathology of, 718
  of soft palate, 989
      symptoms of, 989
  of throat, pathology of, 718
  of tonsil, 1004
    diagnosis of, 1005
    pathology of, 1004
    treatment of, 1005
  of uvula, 989
    symptoms of, 989
Caruncle, adenoma of, 293
  chalky deposits in, 293
  cystic enlargement of, 293
  papilloma of, 292
Casselberry's laryngeal electrode, 919
  modified Allen snare, 918
Cataphoria, 176
Cataract, after-, 485, 497
Cataract, beginning, 487
  capsular, 485
    anterior, 485
    posterior, 485, 497
  choroidal, 502
  complicated, 500
    treatment of, 506
  congenital, etiology of, 500
  cortical, 494
  etiology of, 500
  extraction of, 509
    accidents during the operation, 516
    after-treatment of, 518
    anomalies of healing, 518
    choice of operation, 516
    choroidal hemorrhage following, 517
    with iridectomy, 510
    without iridectomy, 514
    manner of applying dressings after, 513
    modifications of the operation, 515
    simple linear, 509
  following iridocyclitis, 490
  frequency of, in glassblowers, 487
    in the negro race, 487
  hypermature, 491
  lamellar, 499
  lenticular, 486
    circumscribed stationary treatment of, 504
    clinical stages of, hypermature, 493
        incipient, 493
        intumescent, 493
        mature, 493
        swollen, 493
    course of, 492
    diagnosis of, 493
    etiology of, 486
    pathology of, 487
    prognosis of, 496
    symptoms of, 491
    treatment of, 504
      progressive, 504
    use of mydriatics in, 505
      of myotics in, 505
  Morgagnian, 491
  nuclear, 493
  polar, 485
    anterior, 485, 497
    posterior, 485, 486, 497
  "ripe," 489
  secondary, 497, 521
  senile, 488, 489, 490, 491
  traumatic, 481
    etiology of, 482
    treatment of, 483
  treatment of, 503
  zonular, 499
    treatment of, 504
Cataracta accreta, 354
Catarrhal diphtheria, 697
  epiglottitis, 813

Catatropia, 176
Caustics, acid, 750
Cavernoma of conjunctiva, 259
Cavernous sinus, thrombosis of, 201
  etiology of, 201
  infective, 1168
    etiology of, 1168
    prognosis of, 1168
    symptoms of, 1168
  symptoms of, 202
  treatment of, 202
Cells, ethmoidal, 928
  anatomy of, 928
  development of, 928
Cellulitis of the orbit, 195
Cerebellar abscess in middle-ear disease, 1121, 1125
  otic, 1173
    diagnosis of, differential, 1174
    symptoms of, 1173
    treatment of, 1174
Cerebral abscess in middle-ear disease, 1120
  otic, 1169
    diagnosis of, 1171
    etiology of, 1169
    symptoms of, 1169
    treatment of, 1171
  anæmia, relation of, to diseases of the eye, 631
  hemorrhage, relation of, to diseases of the eye, 632
  hyperæmia, relation of, to diseases of the eye, 631
  ptosis, 182
  sclerosis, diffuse, relation of, to diseases of the eye, 642
Cerebro-spinal meningitis, relation of, to diseases of the eye, 639
  rhinorrhœa, 1042
    diagnosis of, 1042
    etiology of, 1042
    symptoms of, 1042
    treatment of, 1043
Cerumen, impacted, 1086
  diagnosis of, 1087
  etiology of, 1086
  prognosis of, 1087
  symptoms of, 1087
  treatment of, 1088
Chalazion, 242, 243
  forceps, Desmarres', 243
  treatment of, 243
Chandler adjustable seat and desk, 141
Chapin's tongue depressor, 735
Check ligament, external, 150
  internal, 150
  ligaments, action of, 150, 151
Chemosis of conjunctiva, 286
Chloral-poisoning, acute, relation of, to diseases of the eye, 606
Cholera, relation of, to diseases of the eye, 620
Cholesterin crystals in the vitreous, 387
Chondroma of larynx, 902
Chondroma, nasal, 892
  of nose, pathology of, 721
  of orbit, 204
  of throat, pathology of, 721
Chorditis nodosa, 827
  diagnosis of, 828
  etiology of, 828
  symptoms of, 828
  treatment of, 827
Chorea of larynx, 1049
Chorioretinitis diffusa syphilitica, absolute and relative ring scotomata in, 374
  pigmenta, contraction of visual field in, 375
  syphilitic, central absolute and relative scotoma in, 374
Choroid, anatomy of, 340
  atrophy of, in glaucoma, 533
  changes in, in myopia, 376
    in primary glaucoma, 532
  coloboma of, 371
  detachment of, 384
  hyperæmia of, 372
  injuries of, 383
  nerves of, 344
  ophthalmoscopic appearance of the, 340
  ossification of, 380
  penetrating wounds of, 383
  pigment stroma, cells of, 341
  rupture of, 384
    treatment of, 384
  sarcoma of, 380
    sectoral contraction in, 375
  tubercular deposits in, 376
Choroidal cataract, 502
  ring, 48
  pigment, function of, 66
"Choroidal disturbance," 487
Choroiditis anterior, 376
  areolaris, 375
  centralis, 375
  diffusa, 376
  disseminata, 376
    chronica, paracentral and pericentral scotomata in, 374
  exudative, acute, 372
      course of, 372
      etiology of, 373
      symptoms of, 372
      treatment of, 373
    varieties of, 375
  suppurativa, 377
    course of, 377
    etiology of, 378
    prognosis of, 378
    symptoms of, 377
    treatment of, 378
Chromatic aberration, 65
Chrysarobin, conjunctivitis due to, 286
Cicatricial ectropion, 233
  entropion, 249
Cilia, 231
Ciliary body, changes in the, in primary glaucoma, 532

- Ciliary body, hyperæmia of, 349
    - macroscopic anatomy of, 338
    - microscopic anatomy of, 338
  - congestion, 24
  - nerves, 343
- Cilio-retinal artery, 51
- Circulation, disturbances of, in relation to diseases of the nose and throat, 689
- Circulatory system, effects of diseases of, upon the eye, 595
- Circulus arteriosus iridis major, 342
    - minor, 342
- Circumcorneal congestion, 24
- Circumlental space, 476
- Cleft palate, 986, 1065
    - etiology of, 1065
    - operation described, 1069
    - symptoms of, 1066
    - treatment of, 1066
- Cocaine-poisoning, relation of, to diseases of the eye, 286, 607
  - use of, in diseases of the nose and throat, 745
- Cohen's laryngeal cotton-holding forceps, 912
- Colloid degeneration, 725
    - pathology of, 725
    - reaction to stains, 725
- Coloboma, choroidal, 371
    - sectoral contraction due to, 374
  - of eyelids, 238
  - iridis, 348
  - of iris, congenital, 348
    - glaucoma following, 552
  - lentis, 477
  - of sheath of the optic nerve, 450
- Color blindness, 568
    - etiology of, 571
    - forms of, 570
    - tests for, 571
  - vision, Young-Helmholtz theory of, 570
  - Young-Helmholtz theory of production of, 54
- Compound hyperopic astigmatism, 100
  - optical systems, 63
- Concave cylinder, 104
  - mirror, use of, in skiascopy, 120
- Concavo-convex lenses, 61
- Congestion, mixed forms of, 24
- Conical cornea, 319, 320
- Conjugate focal distances, 57
  - foci, 57
    - law of, 116
    - relative positions of, 57
  - paralysis, 181
    - prognosis of, 181
    - treatment of, 182
- Conjunctiva, 258
  - abscess of, 286
  - acne of, 292
  - adenoma of, 291
  - amyloid disease of, 284
  - anatomy of, 258
  - angioma of, 259
  - atrophy of, 285
- Conjunctiva, blood supply of, 258
  - bulbar, epithelioma of, 258
  - catarrh of, dry, 259
  - cavernoma of, 259
  - change in, in primary glaucoma, 528
  - chemosis of, 286
  - congenital abnormalities of, 259
  - cysts of, 291
  - dermoid tumors of, 259
  - development of, 336
  - ecchymosis of, 286
  - emphysema of, 286
    - treatment of, 287
  - epithelioma of, 292
  - fibroma of, 259, 291
  - gout of, 267
    - treatment of, 267
  - granuloma of, 291
  - hyperæmia of, 259
  - injuries to, 287
    - treatment of, 287
  - leprosy of, 283
  - lipoma of, 291
  - lupus erythematosus of, 292
  - lymphatic vessels of, 258
  - moles of, 259
  - myxoma of, 291
  - nerve supply of, 259
  - ocular, 258
  - osseous growth of, 259
  - osteoma of, 291
  - palpebral, 258
  - papilloma of, 291
  - pigmented patches of, 259
  - sarcoma of, 292
  - syphilis of, 283
  - tarsal, 258
  - telangiectatic growths of, 259
  - tuberculosis of, 282
    - primary, 282
    - secondary, 283
  - tumors of, benign, 291
    - malignant, 292
    - simple cystic, 291
- Conjunctival congestion, 23
  - sacs, 258
- Conjunctivitis, 259
  - acute contagious, 268
      - complications of, 269
      - contagious qualities of, 269
      - diagnosis of, 269
      - prognosis of, 269
      - prophylaxis of, 269
      - symptoms of, 268
      - treatment of, 269
  - catarrhal, 260
  - catarrhalis æstiva, 261
  - chronic, 284
    - treatment of, 285
  - classification of, 259
  - diphtheritic, 275
    - cause of, 275
    - complications of, 277
    - diagnosis of, 276
    - pathology of, 276
    - pseudomembranous, 276

Conjunctivitis, diphtheritic, treatment of, 277
  eczematosa, 279
  follicular, 262
    cause of, 262
    symptoms of, 262
    treatment of, 262
  gonorrhœal, 270
    acute stage, 270
    cause of, 270
    complications of, 271
    diagnosis of, 271
    pathology of, 275
    prophylaxis of, 271
    treatment of, 272
  granular, 262
    cause of, 264
    diagnosis of, 265
    pathology of, 265
    prognosis of, 265
    treatment of, 265
  lacrymal, 260
    diagnosis of, 260
    treatment of, 260
  lithiasis, 261
    treatment of, 261
  membranous, 277
    cause of, 277
    diagnosis of, 278
    treatment of, 278
  non-specific forms of, 260
  Parinaud's, 267
    cause of, 267
    treatment of, 267
  phlyctenular, 279
    cause of, 279
    diagnosis of, 281
    pathology of, 281
    treatment of, 281
  pneumococcic, 269
    contagious qualities of, 269
    diagnosis of, 270
    prognosis of, 270
  purulent, 270
  simple, 260
    causes of, 260
    prognosis of, 260
    symptoms of, 260
    treatment of, 260
  subacute, 270
    cause of, 270
    contagiousness of, 270
    treatment of, 270
  toxic, 285
    due to atropine, 285
    due to bites of insects, 286
    due to chrysarobin, 286
    due to cocaine, 286
    due to escrine, 286
    treatment of, 286
  vernal, 261
    causes of, 261
    pathology of, 262
    prognosis of, 262
    symptoms of, 261
    treatment of, 262
Conus, annular, 87
  congenital, 87
  terraced, 87
Convergence, 152
  accommodation-, 152
  insufficiency of, 158
  negative, 152, 158
  paralysis of, 181
  punctum proximum, 157
    remotum, 157
  weakness of, 158
Convergent squint, 172
  strabismus, 172
Converging meniscus, 61
Convex spherical test, 163
Cords, vocal, polyps of, 714
Corectopia, 348
Corelysis, 370
Cornea, 293
  abscess of, 305
  anæsthesia of, 529
  anatomy of, 293
  anterior epithelial layer of, 295
  blood-staining of, 322
    treatment of, 323
  burns of, 323
  changes in the, in primary glaucoma, 529
  conical, 319, 320
  deposits upon posterior surface of, in cyclitis, 351
  development of, 335
  ectasiæ of, 317
  fistula of, 305
    treatment of, 306
  foreign bodies in, 321
      treatment of, 322
  infiltration of the, originating from the posterior surface, 316
  injuries of, 321
  manner of testing sensitiveness of, 27
  nerves of, 296
  oblique section of, 296
  sectional view of, 294
  "serpent ulcer" of, 300, 304
  smallness of, as a factor in the causation of glaucoma, 541
  striated opacities of, 315
      treatment of, 316
  tumors of, 324
  ulcer of, acute sloughing, 304
    infected, 300
      central, 302
    serpent, 300, 304
    simple, 300
    variolous, 305
Corneal curvature, application of Placido's disk in determining, 114
  epithelium, mode of demonstrating loss of, 27
  loup, 25
  reflex, examination of the, 24
  tissue, regeneration of, 296
Cornu humanum of external ear, 1083
Cortical cataract, 494
Cough, reflex nasal, 1043

- "Creek dots," 51
- Croup, diphtheritic, 832. (*See* Laryngeal Diphtheria.)
  - pseudo-, 814
    - diagnosis of, 815
    - etiology of, 814
    - pathology of, 815
    - prognosis of, 816
    - symptoms of, 815
    - treatment of, 816
- Crusta lactea, 239
- Cryptophthalmos, 238
- Crystalline lens, 63
  - anatomy of, 474
  - changes in the, in primary glaucoma, 533
  - coloboma of, 477
  - congenital absence of, 477
    - anomalies of, 477
  - cortex, 474
  - deformity of, in a cataract from chronic glaucoma, 503
  - development of, 332
  - dislocation of, 479
    - glaucoma due to, 549, 550
    - into the anterior chamber, 480
    - into the capsule of Tenon, 480
    - into the vitreous chamber, 481
  - embryology of, 476
  - equivalent refractive index of, 63
  - fossa patellaris, 476
  - hyaloid fossa, 476
  - leucocytic infiltration of, 522
  - nucleus of, 474
  - opacities of, 485
  - poles of, 476
  - prismatic fibres of, 475
  - wounds of, 478
    - glaucoma due to, 548
- Curettement of larynx, 919
- Curvature hyperopia, 95
  - myopia, permanent, 85
    - transient, 84
- Cusco's laryngeal forceps, 916
- Cyclitis, course of, 353
  - etiology of, 354
  - primary, 355
  - sequelæ of, 353
    - treatment of, 358
  - serous, glaucoma following, 550
  - symptoms of, 352
  - treatment of, 356
- Cyclophoria, 158
  - detection of, by Maddox double prism, 171
  - treatment of, 171
- Cycloplegic, method of instilling a, 112
- Cycloplegics, necessity for using, 113
  - use of, in determining refractive errors, 112
    - in skiascopy, 124
- Cylinder, convex, 103
- Cylinder, determination of the axis of a, 138
  - distortion produced by a, 138
- Cylinders, application of, in correction of astigmatism, 107
  - bisymmetrical method of indicating the axes of, 105
  - crossed, 108
  - parallel method of indicating the axes of, 105
  - symmetrical method of indicating the axes of, 105
- Cylindrical lenses, 60
- Cysticercus cellulosæ in the vitreous, 388
  - of retina, 438
- Cystoid cicatrix following extraction of cataract, 521
- Cysts of antrum, 979. (*See* Mucocele.)
  - of conjunctiva, 291
  - of eyelids, 244
  - of iris, 359
  - of lacrymal gland, 217
  - of larynx, 722, 901
  - nasopharyngeal, 722
  - of nose, pathology of, 722
  - of orbit, 208
  - polypoid, 880. (*See* Polypoid Cysts.)
  - of throat, pathology of, 722
  - of tonsils, pathology of, 722

- DACRYOADENITIS, acute, 216
    - treatment of, 216
  - chronic, 216
    - treatment of, 216
- Dacryocystitis, 227
  - symptoms of, 227
  - treatment of, 228
- Dacryops, 217
- Dalrymple's sign in exophthalmic goitre, 209
- Daturine-poisoning, relation of, to diseases of the eye, 607
- Daviel's lens scoop, 511
- Day blindness, 580
- Deaf mutism, 1105
    - etiology of, 1105
    - symptoms and diagnosis of, 1106
    - treatment and prognosis of, 1107
- Delstanche's malleus extractor, 1194
  - masseur, 1181
- Dench's ear punch, 1144
- Dendritic keratitis, 307
- Deorsumvergence, 152
- Depression, operation of, in treatment of cataract, 506
- Dermoid tumors of conjunctiva, 259
    - of iris, 359
- Descemet's membrane, 295
- Desiccation keratitis, 307
- Desmarre's chalazion forceps, 243
  - lid retractor, 22
  - secondary knife, 511
- De Wecker's iridotomy scissors, 365
  - iris scissors, 511

- Diabetes insipidus, relation of, to diseases of the eye, 589
  - mellitus, relation of, to diseases of the eye, 586
- Diabetic amblyopia, 458
  - retinitis, 426
- Dieffenbach's method of blepharoplasty, 246
- Diffusion circles, 79
  - images in ametropia, 77, 78
    - in astigmatism, 100, 101
- Digestive system, effects of diseases of, upon the eye, 591
- Dioptre, definition of, 62
- Diphtheria, intubation in, 837
    - after-treatment of, 843
    - instruments for, 838
    - mechanical treatment in, 837
    - operation of, technique of, 839
    - when to operate, 844
      - to remove tube, 845
  - laryngeal, 832
    - diagnosis of, 833
    - pathology of, 832
    - sequelæ of, 834
    - symptoms of, 833
    - treatment of, 834
      - dangers of antitoxin in, 835
  - nasal, 829
    - definition of, 829
    - diagnosis of, 830
      - differential, 830
    - etiology of, 829
    - pathology of, 830
    - symptoms of, 830
    - treatment of, 834
  - of pharynx, 831
    - diagnosis of, 832
      - differential, 833
    - pathology of, 831
    - treatment of, 834
  - relation of, to diseases of the eye, 614
  - varieties of, 697
- Diphtheritic conjunctivitis, 275
  - croup. (*See* Laryngeal Diphtheria.)
- Diplacusis of internal ear, 1104
- Diplobacillus of Morax-Axenfeld, description and pathological significance in diseases of the eye, 683
- Diplococcus of acute follicular catarrh (pseudogonococcus), description and pathological significance in diseases of the eye, 684
  - lanceolatus (pneumococcus) of Fraenkel-Weichselbaum, description and pathological significance in diseases of the eye, 683
- Diplopia, monocular, 103
- Direct astigmatism, 97
  - illumination, determination of refraction by, 117, 118
  - ophthalmoscopic examination, 46
- Disk, optic, 48
- Distichiasis, 248
- Divergence, 152
  - fusion near point, 152
- Divergent squint, 175
  - strabismus, 175
- Diverging meniscus, 61
- Dropsy of antrum, 979. (*See* Mucocele.)
- Dry catarrh of the conjunctiva, 259
- Duboisine-poisoning, relation of, to diseases of the eye, 607
- Duplay's nasal speculum, 731
- Dynamic strabismus, 158
- Dysphagia, hysterical, 1046

- EAR, examination of, 1075
    - instruments used in, 1077
    - technique of, 1079
  - external, cornu humanum of, 1083
    - diseases of, 1080
      - malignant, 1083
    - eczema of, 1080
      - diagnosis of, 1081
      - etiology of, 1080
      - symptoms of, 1080
      - treatment of, 1081
    - foreign bodies in, 1092
      - diagnosis of, 1092
      - prognosis of, 1093
      - symptoms of, 1092
      - treatment of, 1093
    - herpes zoster of, 1082
    - lupus of, 1082
    - tumors of, benign, 1083
  - internal, anatomy of, 1097
    - diplacusis of, 1104
    - diseases of, 1099
    - functional paralysis of, 1104
    - hyperæsthesia of, 1103
    - paracusis of, 1104
    - physiology of, 1097
    - suppurative processes in, 1101
    - tumors of, 1104
  - middle, abscess in, cerebellar, 1121
      - cerebral, 1120
      - extradural, 1119
    - anatomy of, 1108
    - atrophic catarrh of, 1195
      - causation of, 1195
      - diagnosis of, 1197
      - pathology of, 1195
      - prognosis of, 1197
      - symptoms of, 1196
      - treatment of, 1197
    - cerebellar abscess in, 1125
      - pathology of, 1125
    - changes produced in, by deficient blood supply, 1199
    - chronic non-suppurative diseases of, 1176
        - classification of, 1182
      - vascular engorgement, with exudation, 1186
          - diagnosis of, 1188
          - etiology of, 1186
          - prognosis of, 1187
          - symptoms of, 1187

- Ear, middle, deficient blood supply to, 1199
    - changes produced by, 1199
    - diagnosis of, 1199
    - symptoms and signs of, 1199
    - treatment of, 1199
  - disease of, non-suppurative, cicatricial stage of, 1190
      - diagnosis of, 1191
      - prognosis of, 1191
      - symptoms of, 1190
      - treatment of, 1191
        - operative, 1192
    - stages of proliferation and contraction in, 1188
      - prognosis of, 1189
      - symptoms of, 1189
      - treatment of, 1189
  - general infection in, 1125
  - hypertrophic catarrh of, 1182, 1186
    - causes of, 1182
    - pathology of, 1182
    - stages and symptoms of, 1186
  - infective thrombosis in sigmoid sinus, 1122
  - inflammation of, purulent, 1108
    - etiology of, 1110
    - pathology of, 1111
    - prognosis of, 1112
    - symptoms of, 1111
  - inflation of, 1179
  - leptomeningitis, acute, in, 1119
  - pachymeningitis in, 1119
  - sinus phlebitis in, 1124
  - tubercular disease in, 1121
  - relation of diseases of, to diseases of the eye, 595
- Ectasiæ, scleral, 328
- Ectopia lentis, 478
  - pupillæ, 348
- Ectropion, 254
  - cicatricial, 233, 254
  - organic, 254
  - spasmodic, 254
- Eczema of external ear, 1080
    - diagnosis of, 1081
    - etiology of, 1080
    - symptoms of, 1080
    - treatment of, 1081
  - of eyelids, 239
  - relation of, to diseases of the eye, 629
- Eczematous keratitis, 297
- Egyptian ophthalmia, 262, 285
- Electric bulb with reflector for use in operations on the eye, 663
- Electrolysis, 752, 919
  - application of, 752
  - metallic, 753
    - action and use of, 753
  - use and limitations of, 752
- Elephantiasis arabum, relation of, to diseases of the eye, 630
- Elliptical lenses, 60
- Embolism of central artery of retina, 432
  - of cerebral vessels, relation of, to diseases of the eye, 633
- Emmetropia, definition of, 64
- Emmetropic eye, 75
- Emotions, depressing, as a factor in the causation of glaucoma, 541
- Emphysema of conjunctiva, 286
- Empyema of accessory cavities of nose, 982
    - signs of, 982
  - in any accessory cavity, 937
    - symptoms common to, 937
  - of anterior ethmoid cells, 968
    - diagnosis of, 969
    - frequency of, 968
    - prognosis of, 972
    - symptoms of, 969
    - treatment of, 970
  - of antrum of Highmore, 942
    - diagnosis of, 948
    - symptoms of, 942
      - exploratory puncture, 945
      - inspection, 942
      - posture test, 944
      - test of transillumination, 944
    - treatment, 948
      - canine fossa operation, 951
        - after-treatment of, 955
        - technique of, 951
      - indications for, 956
      - through alveolar surface, 949
      - through facial surface, 949
      - through nasal surface, 948
      - through natural orifice, 948
  - complications of, intracranial, 940
    - prognosis of, 941
    - treatment of, 941
  - evidence presumptive of, 937
    - enumeration of points, 937, 938
      - general affections, 940
      - remote symptoms, 939
      - symptoms in neighboring regions, 937
    - prognosis of, 941
    - treatment of, 941
- Encephalocele of orbit, 206
- Enchondroma of orbit, 204
- Enophthalmos, 194
- Enostosis, nasal, 891
- Entozoa in vitreous, 388

Entropion, cicatricial, 249
  spasmodic, 249
Enucleation, operation of, 412
    dangers and advantages of, 414
  scissors, 413
Epicanthus, 238
Epiphora, 218
  etiology of, 218
  treatment of, 221
Episcleritis, fugacious, 325
    cause of, 325
    treatment of, 325
  persistent, 325
    cause of, 326
    prognosis of, 326
    treatment of, 326
Epistaxis, 748
  etiology of, 748
  treatment of, 749
Epithelioma of conjunctiva, 258, 292
  of external ear, 1083
  of nose, pathology of, 718
  of throat, pathology of, 718
Epithelium, retention tumors of, 722
Ergot-poisoning, relation of, to diseases of the eye, 607
Erysipelas of eyelids, 239
  relation of, to diseases of the eye, 611
Erythema bullosum, 691
  multiforme, relation of, to diseases of the eye, 630
Erythrophlæine, effects of, upon color vision, 530
Erythropsia, 581
Eserine-poisoning, relation of, to diseases of the eye, 286, 607
Esophoria, 158
  Maddox's rod-test for, 162
  symptoms of, 167
  treatment of, 167
Esotropia, 172
Ethmoid cells, anterior suppuration in, 967
      closed, 968
        diagnosis of, 968
        etiology of, 968
        symptoms of, 968
        treatment of, 968
      open, latent or manifest, 968
        symptoms of, 969
        treatment of, 970
Ethmoidal cells, 928
    anatomy of, 928
  sinus, affections of, treatment of, 213
    relation of diseases of, to diseases of the eye, 594
    treatment of affections of, 213
  sinusitis, 967
  suppuration, 972
    diagnosis of, 972
    treatment of, 972
      indications for, 972
Ethmoiditis, 708
  histology of, 708
  with nasal polypus, 881, 882
Eucanthus, 292
  maligna, 293
Eustachian catarrh, chronic, 1184
      diagnosis of, 1185
      prognosis of, 1185
      symptoms and signs of, 1184
      treatment of, 1185
  catheter, 1180
Everbusch's operation for correction of ptosis, 235
Evisceration, operation of, 410
    dangers and advantages of, 414
Exenteration, operation of, 410
    dangers and advantages of, 414
  of orbit, 207
Exophoria, 84, 158
  determination of, by parallax test, 163
  etiology of, 164
  Maddox's rod-test for, 162
  symptoms of, 165
  treatment of, 165
Exophthalmic goitre, 208, 589
Exophthalmos, 193
  intermittent, 204
  pulsating, 199
    etiology of, 200
    prognosis of, 200
    symptoms of, 199
    treatment of, 200
Exostosis, ivory, of frontal sinus, 202
  nasal, 891
Exotropia, 158, 175
External auditory meatus, diseases of, 1086
  check ligament, 150
  ear, diseases of, 1080
  ophthalmoplegia, 180
Exudation into anterior chamber in cyclitis, 351
      in iritis, 349
  into posterior chamber in cyclitis, 352
      in iritis, 350
  into stroma of the iris, 349
  into vitreous in cyclitis, 352
Eye, the aphakic, 59
  bloodvessels of, 341, 342
  effects of constitutional diseases upon, 583
    of diseases of the brain, 631
      of circulatory tract 595
      of digestive system, 591
      of nerves, 651
      of respiratory tract, 593
      of sexual organs, 601
      of skin, 629
      of spinal cord, 645
      of urinary organs, 598
    of infectious diseases upon, 608
    of injuries to the brain and spinal cord upon, 650
    of poisons upon, 604
    of trophoneuroses upon, 649
  embryology of, 331

Eye, embryonic bloodvessels of, 333
  emmetropic, 75
  examination of, 19
    anterior chamber, 27
    behavior of the pupil in disease, 31
    bloodvessels of the exterior of the, 23
    ciliary or circumcorneal congestion, 24
    conjunctiva and its cul-de-sacs, 22
    conjunctival congestion, 23
    cornea, 24
    corneal reflex, 24
    direct inspection of the eye and its appendages, 21
    by direct inspection, 26
    by direct method, 46
    family and personal history, 20
    general considerations, 19
      physical condition, 19
    indirect method, 45
    iris, 27
    lacrymal apparatus, 22
    lids, 22
    mixed forms of congestion, 24
    normal eye-ground, 47
    ocular history, 21
    ophthalmoscopic examination, 38
    orbit and the position of the eyeball, 22
    pupil, 29
    tension, 36
    by transmitted light, 40
  foreign bodies in, management of, 401, 403
  general development of, 331
  horizontal section of, in orbit, 148
  hyperopic, 76
  lymph passages of, 344, 345
  myopic, 76, 80
  normal adult, cardinal points of, 64
      curvatures of, 63
      indices of, 63
  nutrition of, 345
  the reduced, 64
  the schematic, 63
  shade, 659
  speculum, 506
  technique of pathological and bacteriological examinations of, 665
Eyeball, atrophy of, 379
  centre of rotation of, 145
  instrument for measuring, 667
  motions of, 145
    derangements of, 145
  penetrating wounds of the, treatment of, 398
  position of rest, 147
  preparation of, for pathological and bacteriological examination, 667
  primary position of, 145
Eyeballs, associated movements, 152
Eye-ground, normal, 47
Eyelids, abscess of, 240
  anatomy of, 231
  angiomata of, 244
  anthrax pustule of, 240
  carbuncle of, 240
  coloboma of, 238
  congenital anomalies of, 238
      treatment of, 238
  cysts of, 244
  development of, 336
  eczema of, 239
  emphysema of, 256
  erysipelas of, 239
  furuncle of, 240
  herpes zoster of, 239
  injuries of, 256
  malignant growths of, 244
  œdema of, 240
  relative positions and sizes of, 232
  syphilis of, 241
  tumors of, 244
  ulcers of, 240
  variolous eruption upon, 240
Eyes, artificial, 416

FACIAL hemiatrophy, progressive, relation of, to diseases of the eye, 650
  nerve, relation of paralysis of the ocular branch of, to diseases of the eye, 652
Factitious myopia, 84
Facultative hyperopia, 96
Far point in hyperopia, 90
    in myopia, 80
      direct determination of, 124
Farlow's operation for forward prolongation of septum, 762
  punch forceps, 998
Farsightedness, 76
Fascicular keratitis, 298
Favus, relation of, to diseases of the eye, 630
Fibræ arcuatæ, 295
Fibroangioma of nose, pathology of, 722
  of throat, pathology of, 722
Fibroma of conjunctiva, 291
  of external ear, 1083
  intranasal, 885
  of larynx, 901
  of nasopharynx, 1032
    diagnosis of, 1033
    histological pathology of, 1032
    prognosis of, 1033
    symptoms of, 1033
    treatment of, 1033
      cold wire snare in, 1034
      electrolysis in, 1034
      evulsion of, 1035
      external operation for, 1035
      galvanocautery in, 1034
  of nose, pathology of, 720
  papillare, 887
  of throat, pathology of, 720
Field of fixation, 154
    binocular, limits of, 156
    monocular, 154

Field of fixation, monocular, limits of, 156
    measurement of, by means of the perimeter, 155
Filamentous keratitis, 306
Filaria sanguinis hominis in the vitreous, 388
Fissure, orbital, inferior, 192
    superior, 192
  palpebral, 193
Fistula of cornea, 305
  of lacrymal gland, 217
  lacrymalis, 228
Fixation forceps, 506
  point, method of determining, 42
Focal interval, 99
Foci, conjugate, 57
    relative positions of, 57
Focus, real, 57
  principal, 57
  virtual, 57
Follicular conjunctivitis, 262
Foreign bodies in accessory sinuses, 981
    in external ear, 1092
    in nose, 874
      removal of, 750
    in pharynx, 1016
      symptoms of, 1016
      treatment of, 1016
    removal of, 915
    in throat, 874
    in tonsils, 1003
Fornix conjunctivæ, 258
Förster's photometer, 35
Fossa patellaris of the crystalline lens, 476
Fox's fixation forceps, 412
Fracture of nose, 1056
    treatment of, 1056
Fränkel's nasal speculum, 731
Frenular keratitis, 298
Freudenthal's electric vibrator, 755
Fricke's method of blepharoplasty, 245
Frog, entire embryo of a, 331
Frontal sinus, 926
    chronic mucocele of, 210
    development of, 927
    ivory exostosis of, 202
    operation on, 961
      exploration of frontonasal duct, 963
      progress of, 965
      Kuhnt's operation, 966
  sinuses, relation of diseases of, to diseases of the eye, 594
  suppuration, 972
    diagnosis of, 972
    treatment of, 972
      indications for, 972
Frost-bite of auricle, 1085
Fulminating glaucoma, 542
Fundus reflex, 42
  variations in color of, 371
Fungus-poisoning, relation of, to diseases of the eye, 607
Furrow keratitis, 307
Furuncle of eyelid, 240
  relation of, to diseases of the eye, 630
Fusion near point in divergence, 152

GALTON whistle, 1177
Ganglion cells of the retina, method of staining, 678
Gangrenous pharyngitis, 1013
Gauss, formula of, 64
Gerontoxon, 317
Glanders, 706
Glandular enlargement, general, relation of, to diseases of the eye, 590
Glands, Meibomian, 232
  ocular, development of, 336
  of Zeiss, 231
Glassblowers, frequency of cataract in, 487
Glasses, adjustment of, 136
  analysis of, 138
  difficulties encountered in wearing, 134
  rules for the prescription of, 131
Glaucoma, absolute, ophthalmoscopic appearance of the optic disk in, 537
    section of the optic nerve head in, 537
  acute, clinical application of treatment in, 565
    congestive, 542
  age as a factor in causation of, 540
  changes in the conjunctiva in, 528
  chronic deformity of lens in a cataract from, 503
    non-congestive, 544
  congenital, 553
  cupping of the optic disk as a result of glaucoma, 538
  following extraction of cataract, 521
  fulminating, 542
  heredity as a factor in causation of, 540
  loss of sleep as a factor in causation of, 541
  primary, changes in the anterior chamber in, 530
      in the aqueous humor, 533
      in the choroid, 532
      in the ciliary body, 532
      in the cornea, 529
      in the crystalline lens, 533
      in the iris, 531
      in the optic nerve, 537
      in the retina, 533
      in the sclerotic, 528
      in the vitreous humor, 533
    clinical types of, 542
    diagnosis of, 545
    predisposing conditions, 540
      accommodative effort, 541
      age, 540
      constitutional conditions, 541
      depressing emotions, 541

Glaucoma, primary, predisposing conditions, errors of refraction, 541
        heredity, 540
        local injuries, 541
        loss of sleep, 541
        operation on one eye, 541
        race, 540
        sex, 540
        smallness of cornea, 541
        use of mydriatics, 541
      treatment of, 556
    secondary, varieties of, 546
    simplex, concentric contraction of fields of vision in, 535, 536
    subacute, 543
Gleason's nasal speculum, 731
Glioma of retina, 438, 439
Glycosuric amblyopia, 577
Goitre, exophthalmic, 208, 589
      etiology of, 208
      symptoms of, 208
      treatment of, 209
Gonococcus (Neisser), description and pathological significance in diseases of the eye, 683
Gottstein's curette, 1030
Gould's prism battery, 159
Gout of conjunctiva, 267
Grant's guarded forceps, 916
Granular conjunctivitis, 262
    pharyngitis, chronic, 1010
      etiology of, 1010
      symptoms of, 1011
      treatment of, 1011
Granuloma of conjunctiva, 291
Graves' disease, 208
      relation of, to diseases of the eye, 589
Green blindness, 570
Green's (J.) operation for cicatricial entropion, 251
Green's powder blower, 912
Gruber's speculum, 1077
Gruening's modified Hotz suture operation for correction of ptosis, 235
Grünwald's forceps, 953

HAAB'S magnet, 405
    reflex, 34
Hæmatoma of uvula, 988
Hæmophilia of nose, pathology of, 690
    relation of, to diseases of the eye, 585
    of throat, pathology of, 690
Hajek's hook for opening sphenoidal sinus, 977
Hartmann's ear forceps, 1135, 1142
    nasal speculum, 731
    rongeur forceps, 1152
"Harvesters' keratitis," 304
Hasner's valve, 216
Hayes' knife needle, 506
Hay fever, 798
      definition of, 798
Hay fever, diagnosis of, 801
      etiology of, 798
      prognosis of, 801
      symptoms of, 800
      treatment of, 802
Hearing, subjective sensations of, 1103
    testing of, 1176
Helmholtz's theory of the mechanism of accommodation, 67
Hemeralopia, 580
Hemianopic pupillary inaction sign, 34
Hemianopsia, left-sided, 467
Hemifacial hypertrophy, relation of, to diseases of the eye, 650
Hemorrhage, amblyopia from, 578
    into the anterior chamber, 362
    of nose, 690
    from pharynx, 1015
    of throat, 690
    into the vitreous, 388
Hemorrhagic retinitis, 427, 428, 429
Herpes conjunctivæ, 261
    corneæ, 310
      treatment of, 310
    pharyngis, 691
    vulgaris, relation of, to diseases of the eye, 630
    zoster of external ear, 1082
      of nose, histology of, 690
      ophthalmos, 239
      relation of, to diseases of the eye, 630
      of throat, histology of, 690
Heterochromia, 346
Heterophoria, 158
    determination of, by convex spherical test, 163
      by parallax test, 163
    image movement in, 164
    red glass test in, 160
    spasmodic, 184
    symptoms of, 164
Heterotropia, 172
    exercise of the weak eye in, 190
    use of the stereoscope in, 191
Heurteloup artificial leech, 356, 357
Hippus, 30
Hirschberg's pupillometer, 29
    sideroscope, 406
Hoen's degeneration of uvula, 724
      histology of, 725
Holmgren's wool-test for detection of color blindness, 571
Homatropine-poisoning, relation of, to diseases of the eye, 607
    use of, as a mydriatic, 112
Hordeolum, 242
Hutchinson teeth, 313, 314
Hyaline degeneration, 725
      pathology of, 725
      reaction to stains, 725
Hyalitis, 385
    asteroid, 385
    punctata, 385
    suppurativa, 386
    treatment of, 386

Hyaloid artery, persistent, 385
  canal, 344, 345
  fossa of crystalline lens, 476
  membrane of vitreous, glaucoma following anterior synechiæ of, 548
Hydrocephalus, relation of, to diseases of the eye, 644
Hydrophthalmos, 321
Hydrops antri, 979. (*See* Mucocele.)
  inflammatarius, 979
Hydrorrhœa, nasal, 1041
    prognosis of, 1042
    symptoms of, 1042
    treatment of, 1042
Hyoscyamine-poisoning, relation of, to diseases of the eye, 607
Hyperæmia, 689
Hyperæsthesia of internal ear, 1102
  of larynx, 1046
    treatment of, 1046
  of nose, 1040
  of pharynx, 1043
    diagnosis of, 1044
    etiology of, 1043
    symptoms of, 1044
    treatment of, 1044
Hyperesophoria, 158
Hyperexophoria, 158
Hyperkinesis, 158
Hypermetropia, 76
  correction of, by a convex lens, 43
Hyperopia, 76, 90
  absolute, 96
  accommodation in, 93
  amount of, 96
  axial, 95
  correction of, 91
  course of emergent rays in, 90
  curvature, 95
  external evidences of, 97
  facultative, 96
  far point in, 90
  index, 95
  latent, 94
  manifest, 94
  near point in, 93
  prescribing glasses for, 132
  relative, 96
  symptoms of refractive errors in, 110
  total, 94
  varieties of, 95
  vision in, 96
Hyperopic eye, 76
Hyperosmia, 1038
  prognosis of, 1038
  symptoms of, 1038
  treatment of, 1038
Hyperosphresia, 1038
  prognosis of, 1038
  symptoms of, 1038
  treatment of, 1038
Hyperphoria, 158
  determination of, by parallax test, 163
  image movement in, 166
  left, Maddox's rod-test for, 162
  right, Maddox's rod-test for, 162
  symptoms of, 169
  tests for, 170
  treatment of, 170
Hypertropia, 176
Hypertrophic catarrh of middle ear, 1182
    causation of, 1182
    chronic, 1186
      cicatricial or post-catarrhal stage, 1190
        diagnosis of, 1191
        prognosis of, 1191
        symptoms of, 1190
        treatment of, 1191
      stage of engorgement of vessels with exudation, 1186
        diagnosis of, 1188
        prognosis of, 1187
        treatment of, 1188
      stages of proliferation and contraction, 1188
        prognosis of, 1189
        symptoms of, 1189
        treatment of, 1190
    pathology of, 1182
  subglottic inflammation, 715
Hypertrophy of pharyngeal tonsil, 1022
  of tonsils, 996
    etiology of, 996
    symptoms of, 996
    treatment of, 997
      local, 997
      operative, 999
        after-treatment of, 1002
        cold wire snare in, 1001
        electric wire snare in, 1001
        enucleation in, 1003
        guillotine in, 999
  of ventricular region, 713
Hyphæmia, 350, 362
Hypoesophoria, 158
  image movement in, 166
Hypoexophoria, 158
  image movement in, 166
Hypokinesis, 1052
Hypophoria, 158
Hypopyon, 297

Hypopyon keratitis, 303
Hysteria, extreme concentric contraction in, 575
Hysterical amblyopia, 574

ICHTHYOSIS, relation of, to diseases of the eye, 630
Illumination, focal, 26
  oblique, 26
Image, retinal, mental projection and rectification of, 66
Images, formation of, 55
  diffusion, in ametropia, 77, 78
Impetigo, relation of, to diseases of the eye, 631
Index, equivalent refractive, of crystalline lens, 63
  hyperopia, 95
  myopia, 84, 85
  relative refractive, 56
Infectious diseases, effects of, upon the eye, 608
Inflammation, chronic nasal, with tendency to atrophy, 716
  circumscribed, of external auditory meatus, 1089
    diagnosis of, 1089
    etiology of, 1089
    symptoms of, 1089
    treatment of, 1089
  diffuse, of external auditory meatus, 1090
    etiology of, 1090
    symptoms of, 1090
    treatment of, 1091
  hypertrophic subglottic, 715
  of lymphoid tissue, 693
    due to micro-organisms, 697
  of mucous membranes, 693
  of nose, 690, 706
    chronic, with atrophy, 690
      with hypertrophy, 690
    infectious, 692
      etiology of, 692
    neurotic, 690
    pathology of, 706
    traumatic, 692
      etiology of, 692
    varieties of, 690
  parenchymatous, 706
  perichondrial, 706
  periosteal, 706
  submucous, 695
    pathology of, 695
  superficial, 706
  suppurative of middle ear, 1160
    intracranial complications of, 1160
Influenza, 806
  complications of, 807
  diagnosis, differential of, 807
  etiology of, 806
  pathology of, 698, 699
  prognosis of, 807
  relation of, to diseases of the eye, 619
  symptoms of, 806
Influenza, treatment of, 807
Infraduction, measurement of, 154
Insanity, relation of, to diseases of the eye, 640
Internal ear, diseases of, 1099
Interstitial keratitis, 311
Intervaginal space, 345
Intracranial complications of empyema, 940
Intralaryngeal injections, 860
Intranasal adenoma, 890
    diagnosis of, 891
    etiology of, 890
    pathology of, 890
    prognosis of, 891
    symptoms of, 891
    treatment of, 891
  adhesions, 751
    etiology of, 751
    symptoms of, 751
    treatment of, 751
  angioma, 888
  carcinoma, 892
    diagnosis of, 893
    forms of, 893
    pathology of, 893
    symptoms of, 893
  catheter syringe, 742
  fibroma, 885
    diagnosis of, 887
    etiology of, 885
    pathology of, 886
    prognosis of, 887
    symptoms of, 886
    treatment of, 887
  osteoma, 891
  papilloma, 887
    diagnosis of, 888
    forms of, 887
    prognosis of, 888
    symptoms of, 887
    treatment of, 888
  polypus, 884
  sarcoma, 893
    diagnosis of, 895
    etiology of, 895
    microscopical appearance of, 895
    pathology of, 894
    prognosis of, 895
    symptoms of, 895
    treatment of, 896
Intra-ocular fluid, composition of, 524
  tumor, glaucoma following, 551
Intubation in diphtheria, 837
Intumescent cataract, 493
Iodine-poisoning, relation of, to diseases of the eye, 605
Iridectomy 365, 367, 369
  indications for, 367
  in treatment of glaucoma, 556
Iridectomydialysis in treatment of glaucoma, 556
Irideræmia, 348
  traumatica, 361
Iridesis, 370

- Iridochoroiditis following extraction of cataract, 519
- Iridocyclitis, extraction following, 490
  - following extraction of cataract, 519
    - perforating injury, 352
  - secondary, 356
  - sympathetica, 356
- Iridodialysis, 361, 369
- Iridodonesis, 28
- Iridoplegia, 33
  - reflex, 32
  - unilateral, 32
- Iridotomy, 369, 370
- Iris, anatomy of, 336, 337
  - anterior synechiæ of, glaucoma following, 547
  - bombé, 353, 546
  - changes in the, in primary glaucoma, 531
  - chromatic asymmetry of, 27
  - coloboma of, congenital, 348
    - glaucoma following, 552
  - cysts of, 359
  - exudation into the stroma of, 349
  - factors influencing color of, 338
  - forceps, 508
  - foreign bodies in, 361
  - function of, 65
  - hooks, 364
  - hyperæmia of, 348
  - inflammatory diseases of, 348
  - innervation of, 28
  - inversion of, 362
  - lacerations of, 361
  - melanomata of, 359
  - operations upon, 363
  - penetrating wounds of, 361
  - piebald, 27
  - posterior layers of the, of an albinotic human eye, 337
    - synechiæ of, following glaucoma, 546
  - prolapse of, following extraction of cataract, 519, 520
  - scissors, 412
  - traumatic changes in, 362
  - tumors of, benign, 359
    - treatment of, 359
    - dermoid, 359
    - malignant, 359
      - treatment of, 360
  - variations in color of, 346
- Iritis, 349
  - course, 353
  - diabetica, 355
    - treatment of, 358
  - etiology of, 354
  - gonorrhœica, 355
    - treatment of, 358
  - idiopathica, 355
  - primary, 355
  - in relapsing fever, 355
  - rheumatica, 355
    - treatment of, 358
  - scrofulosa, 355
  - secondary. 356
- Iritis, sequelæ of, 353
    - treatment of, 358
  - symptoms of, 352
  - syphilitic, 355
    - treatment of, 358
  - traumatica, 356
  - treatment of, 356
  - tuberculosa, 355
  - in variola, 355

- JACKSON'S binocular magnifier, 26
  - Jaesche-Arlt operation in treatment of trichiasis, 249
- Jarvis' nasal snare, 764
- Javal and Schiötz's ophthalmometer, 114, 115

- KERATECTASIA, 319
  - treatment of, 319
- Keratitis arborescens, 307
  - bandolet, 316
  - bullous, 310
    - pathology of, 311
    - treatment of, 311
  - dendritic, 307, 630
  - desiccation, 307
    - symptoms of, 308
    - treatment of, 308
  - eczematous, 297
    - complications of, 299
    - diagnosis of, 299
    - prognosis of, 299
    - symptoms of, 297
    - treatment of, 299
  - fascicular, 298
  - filamentous, 306
    - idiopathic, 306
    - symptoms of, 306
    - traumatic, 306
    - treatment of, 306
  - frenular, 298
  - furrow, 307
  - harvesters', 304
  - hypopyon, 303
  - marginal, 300
    - diagnosis of, 302
    - duration and symptoms of, 301
    - treatment of, 302
  - mycotic, 307
  - neuroparalytic, 308
    - treatment of, 309
  - oyster shuckers', 300, 304
  - parenchymatous, 311
    - symptoms of, 313
    - treatment of, 314
  - phlyctenular, 297
  - punctata superficialis, 310
  - ramiformis, 630
  - ribbon, 316
  - sclerosing, 314
    - symptoms of, 315
    - treatment of, 315
  - scrofulous, 297
  - suppurative forms of, 297
  - trophic, 316
  - vascular, deep, 316

- Keratitis, vascular, deep, cause of, 316
      - symptoms of, 316
      - treatment of, 316
- Keratitise lagophthalmo, 307
- Keratoconus, 319
  - diagnosis of, 320
  - symptoms of, 320
  - treatment of, 320
- Keratoglobus, 321
  - pellucida, 321
  - turbidus, 321
- Keratomalacia, 308
- Keratomes, 364
- Keratometry, determination of corneal curvature in astigmatism by, 114
- Keratoscope, 25
- Keratosis, pathology of, 723
- Klebs-Loeffler diphtheria bacillus, description and pathological significance in diseases of the eye, 684
- Knapp's expression forceps, 266
  - method of blepharoplasty, 245, 247
  - operating-chair, 662
- Knight's tonsil galvanocautery snare, 1001
- Koch-Weeks bacillus, description and pathological significance in diseases of the eye, 683
- Krönlein's osteoplastic resection, 205

- LACRYMAL apparatus, anatomy of, 214
  - duct, 215
    - testing patency of, 221
  - gland, 214
    - cyst of, 217
    - dislocation of, 218
    - extirpation of, 231
    - fistula of, 217
    - hypertrophy of, 217
    - suppurative inflammation of, 216
    - tumors of, 217
  - sac, 215
    - extirpation of, 230
- Lacunar tonsillitis, 991
    - etiology of, 991
    - symptoms of, 991
    - treatment of, 992
- Lagophthalmos, 232
  - treatment of, 233
- Lake's attic curette and incus hook, 1194
- Lamellar cataract, 499
- Lamina cribrosa, 48
  - vitrea, 340
- Landolt's ophthalmodynamometer, 157
- Laryngeal diphtheria, 832
    - diagnosis of, 833
    - pathology of, 832
    - sequelæ of, 834
    - symptoms of, 833
    - treatment of, 834
      - dangers of antitoxin, 835
  - paralysis, 1052
    - bilateral abductor, 1053
- Laryngeal paralysis, etiology of, 1052
    - recurrent, 1053
    - unilateral abductor, 1053
  - ventricle, prolapse of, 903
- Laryngitis, acute, 810
    - in childhood, 814
      - diagnosis of, 815
      - etiology of, 814
      - pathology of, 815
      - prognosis of, 816
      - symptoms of, 815
      - treatment of, 816
    - etiology of, 810
    - symptoms of, 811
    - treatment of, 816
  - chronic, 712, 818
    - diagnosis of, 821
    - diffuse hypertrophic, 712
    - dry, 823
      - etiology of, 824
      - symptoms of, 824
      - treatment of, 824
    - etiology of, 712, 818
    - hypoglottic, 822
      - diagnosis of, 823
      - etiology of, 822
      - prognosis of, 823
      - symptoms of, 822
      - treatment of, 823
    - pathological changes in, 712
    - prognosis of, 821
    - symptoms of, 819
    - treatment of, 821
  - hæmorrhagica, 813
    - pathology of, 813
    - symptoms of, 813
    - treatment of, 816
  - hypoglottica, 813
    - etiology of, 814
    - pathology of, 814
    - symptoms of, 814–16
    - treatment of, 816
  - and nasopharyngitis, 716
  - pachydermia, 825
    - diagnosis of, 826
    - etiology of, 825
    - prognosis of, 827
    - symptoms of, 825
    - treatment of, 827
  - rheumatic, 812
    - etiology of, 812
    - symptoms of, 812
    - treatment of, 816
  - sicca acuta, 812
      - description of, 812
      - treatment of, 816
- Laryngoscope, how to use, 737
  - methods of illuminating, 738
- Laryngoscopy, 736
  - instruments and methods, 736
- Larynx, adenoma of, 903
  - anæsthesia of, 1046
  - angioma of, 902
  - carcinoma of, 904
    - diagnosis of, 905
      - differential, 905

- Larynx, carcinoma of, etiology of, 904
    - pathology of, 904
    - prognosis of, 906
    - symptoms of, 905
    - treatment of, 906
  - chondroma of, 902
    - diagnosis of, 902
    - etiology of, 902
    - symptoms of, 902
    - treatment of, 903
  - chorea of, 1049
  - curettement of, 919
  - cysts of, 722, 901
  - fibroma of, 901
  - fracture of, 920
  - hyperæsthesia of, 1046
    - treatment of, 1046
  - injuries of, 919
  - lipoma of, 902
  - lupus of, 866
    - diagnosis of, 867
    - pathology of, 866
    - symptoms of, 866
    - treatment of, 867
  - myxoma of, 901
  - neoplasms of, 897
    - diagnosis of, 899
      - differential, 899
    - etiology of, 898
    - malignant, 904
    - pathology of, 898
    - prognosis of, 900
    - symptoms of, 899
    - treatment of, 900
  - neuralgia of, 1047
  - neurosis of, 1046
    - motor, 1047
  - papilloma of, 897
  - paræsthesia of, 1047
  - paralysis. (*See* Laryngeal Paralysis, 1052.)
  - relation of diseases of, to diseases of the eye, 595
  - sarcoma of, 908
    - diagnosis of, 909
    - etiology of, 908
    - pathology of, 909
    - sites of, 908
    - symptoms of, 909
    - treatment of, 909
  - spasm of, in adults, 1049
      - diagnosis of, 1049
      - etiology of, 1049
      - symptoms of, 1049
      - treatment of, 1049
    - in childhood, 1047
      - diagnosis of, 1048
      - etiology of, 1047
      - symptoms of, 1047
      - treatment of, 1048
    - phonatory, 1049
  - stenosis of, 867
    - etiology of, 867
      - pathology of, 867
      - symptoms of, 868
      - treatment of, 868
- Larynx, syphilis of, 848
    - secondary, 848
      - diagnosis of, 848
      - pathology of, 848
      - symptoms of, 848
      - treatment of, 848
    - tertiary, 851
      - pathology of, 851
      - treatment of, 851
    - thyroid tumor of, 903
  - traumatism of, 919
  - treatment of, 910
    - apparatus for, 910
    - local, 910
      - anæsthesia, 914
    - medicinal, 910
    - methods of, 910
    - nebulizers and atomizers, 911
    - surgical, 910
      - methods, 914
  - tuberculosis of, 701, 853
    - clinical appearance of, 702
    - diagnosis of, 855
    - pathology of, 702, 853
    - prognosis of, 864
    - symptoms of, 854
      - appearances, 855
      - expectoration and secretion 854
    - treatment of, 859
      - cautery, 864
      - intralaryngeal injections, 860
      - intubation, 864
      - local, 860
      - submucous injections, 863
      - tracheotomy, 864
  - tumors of, 897
  - vertigo of, 1051
    - etiology of, 1051
    - prognosis of, 1052
    - symptoms of, 1052
    - treatment of, 1052
  - wounds of, 920
- Le Conte's scheme for detection of color blindness, 571
- Lead-poisoning, chronic, relation of, to diseases of the eye, 460, 605
- Lens capsule, glaucoma following anterior synechiæ of, 548
  - development of, 332
  - fibres, primitive, 332
  - focal length of a, 62
  - refraction, 60
      - cardinal points in, 62
- Lenses, classification of, 60
  - numeration of, 62
- Lenticonus, 478
- Lenticular cataract, 486
  - opacities, 486, 498, 504
    - diagrammatic method of determining location of, 495
- Leprosy of conjunctiva, 283
  - of nose, 867
    - pathology of, 704
  - relation of, to diseases of the eye, 627

Leprosy of throat, 867
    pathology of, 704
Leptomeningitis, acute, in middle-ear inflammation, 1119
  purulent, 1162
    diagnosis of, 1163
    etiology of, 1162
    in mastoiditis, 1119
    prognosis of, 1163
    symptoms of, 1162
    treatment of, 1163
  serous, 1162
    diagnosis of, 1162
    symptoms of, 1162
    treatment of, 1162
  tubercular, in mastoiditis, 1121
Leptothrix mycosis, 705
    clinical appearance of, 705
    morbid anatomy of, 705
Leukæmia, relation of, to diseases of the eye, 584
Leukæmic retinitis, 427
Levis' wire loop, 511
Lichen ruber, relation of, to diseases of the eye, 630
Lid retractor, Desmarres', 22
Liebreich bandage, modified, 659
Ligament, external check, 150
  internal check, 150
Ligamentum pectinatum, 338, 339
Light pencil, 54
  ray, 54
  sense, manner of testing, 35
  waves, 53
Lightning flash, amblyopia from, 578
Lingual tonsil, 1005. (*See* Tonsil, Lingual.)
Lipoma of conjunctiva, 291
  of larynx, 902
  nasal, 892
    pathology of, 720
  of orbit, 204
  of throat, pathology of, 720
Lithiasis conjunctivitis, 261
Longsightedness, 76
Loring's ophthalmoscope, 39
Loup, corneal, 25
Ludwig's angina, 1013. (*See* Phlegmonous Pharyngitis.)
Luer's eye speculum, 412
Lupus, erythematosus, of conjunctiva, 292
  of external ear, 1082
  of larynx, 866
    diagnosis of, 867
    pathology of, 866
    symptoms of, 866
    treatment of, 867
  of nose, 865
    diagnosis of, 866
    etiology of, 866
    histological pathology of, 702
    symptoms of, 866
    treatment of, 867
  of pharynx, 866
  of throat, 865
Lupus of throat, diagnosis of, 866
    etiology of, 866
    histological pathology of, 702
    symptoms of, 866
    treatment of, 867
Lymph passages of eye, 344, 345
  tissue, atrophy of, 725
Lymphadenoma of orbit, 204
Lymphangiectasis, 290
  treatment of, 290
Lymphangioma of orbit, 204
Lymphoid tissue, inflammation of, 693
Lymphoma of orbit, 204

McCOY'S laryngeal porte caustique, 914
McHardy perimeter, 444
McKay's ear forceps, 1141
Macewen's burrs, 1156
Mackenzie's bull's-eye lens and reflector, 1077
  cutting forceps, 915
  tonsillotome, 1000
Macula, 52
  holes at the, 438
  lutea, 65
  symmetrical disease of, in young children, 431
Madarosis, 240
Maddox double prism, use of, in detecting cyclophoria, 171
  multiple rods, 161
  rod-test for esophoria, 162
    for exophoria, 162
    for hyperphoria, 162
    for orthophoria, 162
Malaria, relation of, to diseases of the eye, 617
Malarial amblyopia, 577
Mallory's methods for staining neuroglia, 679
Marchi's method for staining specimens of the optic nerve, 678
Massage, 754
  benefits of, 754
  indications for, 754
  methods of application, 755
Mastoid disease, relation of diseases of, to diseases of the eye, 595
  periostitis, acute, 1146
      causes of, 1146
      pathology of, 1147
      treatment of, 1147
Mastoiditis, 1116, 1147
  brain abscess in, 1121
  diagnosis of, 1148
  eburnation in, 1118
  etiology of, 1116, 1147
  pathology of, 1116
  prognosis in, 1159
  purulent leptomeningitis in, 1119
  symptoms and pathology of, 1116, 1147
  treatment of, 1148
    operative, 1149
      after-treatment, 1159

Mastoiditis, tubercular leptomeningitis in, 1121
Mathieu's tonsillotome, 999
Mauthner's scheme for detection of the affected muscles in ocular paralysis, 178, 179
Maxillary sinus, 923
    chronic suppuration of, 942
  suppuration, 972
    diagnosis of, 972
    treatment of, 972
      indications for, 972
Measles, relation of, to diseases of the eye, 613
Meatus, middle, pus in, 982
      diagnosis of, 982
      differential, 982
Megalocornea, 321
Megalopsia, 581
Meibomian glands, 232
Melanomata of iris, 359
Membrana pupillaris perseverans, 346
      treatment of, 348
  tympani, wounds of, 1094
      etiology of, 1094
      symptoms of, 1096
      treatment of, 1096
Membrane, Bowman's, 295
  Descemet's, 295
  persisting papillary, 346
Membranous conjunctivitis, 277
Meningitis, relation of, to diseases of the eye, 637
Meniscus, converging, 61
  diverging, 61
Mercury-poisoning, acute, relation of, to diseases of the eye, 605
Meridianal aberration, 97
Metamorphopsia, 581
Metastatic purulent meningitis, relation of, to diseases of the eye, 639
Methyl alcohol, as a cause of blindness, 606
Metre angle, 152
Microphakia, 477
Micropsia, 581
Microtome, knife for, 666
  medium laboratory, 665
Middle ear, catarrh of, atrophic, 1195
      hypertrophic, 1186
    chronic vascular engorgement of, 1186
    deficient blood supply to, 1199
    disease, cicatricial stage of, 1190
      proliferation and contraction in, 1188
    purulent inflammation of, 1108
Migraine, ophthalmoplegic, 180
  scintillating scotoma in, 579
Milium, relation of, to diseases of the eye, 630
Mind blindness, 471
Moles of conjunctiva, 259
Molluscum contagiosum, 244
    relation of, to diseases of the eye, 630
Molluscum, simplex, 244
Monocular diplopia, 103
  field of fixation, limits of, 156
      measurement of, by means of the perimeter, 155
  squint, 172
Morgagni, spheres of, 489
Morgagnian cataract, 491
Morton's ophthalmoscope, 39
Motais' operation for correction of ptosis, 236
Mucocele, 223, 979
  chronic, 210
    treatment of, 211
  course of, 224
  in infants, 226
    treatment of, 226
  pathology of, 980
  symptoms of, 224, 979
  treatment of, 224, 980
Mucosa, tumors of, retention, 722
      lymphatic, 722
      vascular, 722
Mucous degeneration, pathology of, 723
  membranes, inflammation of, 693
Mules' operation for ptosis, 236
  vitreous spheres, 410
      introducer for, 411
Müller's fluid, composition of, 667
  muscle, 232
Mumps, relation of, to diseases of the eye, 620
Muscæ volitantes, 110
Muscle, advancement of a, 186, 187, 188
  external rectus, attachment of, 148
      origin of, 147
      paralysis of, 179
  extra-ocular, insertion of the, 149
  extrinsic, in localization of cerebral diseases, 182
  inferior oblique, origin of, 148
      paralysis of, 181
    rectus, origin of, 148
      paralysis of, 181
  internal rectus, attachment of, 148
      origin of, 147
      paralysis of, 181
  ocular, anatomy and physiology of, 145
    development of, 336
    external, 145
      rectus, 147
    extrinsic, 145
      innervation of, 145
    inferior oblique, 148
      rectus, 148
    insufficiency of, 158
    internal, 145
      rectus, 147
    intrinsic, 145
    nerve supply of, 151
    operations on, advancement of a muscle, 186
      tenotomy, 186
    paralysis of, 176
      diagnosis of, 177

- Muscle, ocular, paralysis of, etiology of, 176
      - relations of the double images in, 178
      - symptoms of, 176
    - superior oblique, 148
      - rectus, 148
  - orbital, attachment of, 146
    - unilateral paralysis of, 179
  - producing lateral excursions, testing functions of, 159
    - vertical excursions, testing functions of, 159
  - testing balance of the, at the near point, 159
  - superior oblique, origin of, 148
      - paralysis of, 180
    - rectus, origin of, 148
      - paralysis of, 180
  - thyro-arytenoidei, paralysis of, 1054
- Muscular asthenopia, 109
  - fibres, degeneration of, in uvula, 724
  - imbalance, 158
- Musculus ciliaris Riolani, 232
- Mycosis, 1015
  - fungoides, 704
  - symptoms of, 1015
  - treatment of, 1015
- Mycotic keratitis, 307
- Mydriasis, paralytic, 33
  - spastic, 32
  - transient, 33
- Mydriatics, use of, as a factor in the causation of glaucoma, 541
  - use of, in lenticular cataract, 505
- Myles' nasal speculum, 731
  - trocar and canula, 946
- Myopia, 76
  - accommodation in, 82
  - accommodative, 84
  - axial, 84, 85
  - changes in the choroid in, 376
  - complications of, 86
    - conus, 87
    - fundus changes, 87
    - sclero-choroiditis, posterior, 87
  - congenital, 88
  - correction of, 81
  - course of emergent rays in, 81
  - curvature of, permanent, 85
    - transient, 84
  - external evidences of, 89
  - factitious, 84
  - far point in, 80
      - direct determination of, 124
  - index, 84, 85
  - near point in, 82
  - pernicious, 88
  - prescribing glasses for, 131
  - progress of, 87
  - progressive, 88
  - school, 88
  - symptoms of refractive errors in, 109
  - vision in, 89
- Myopic eye, 76, 80
- Myosis, paralytic, 31, 32
- Myosis, spastic, 31, 32
- Myotics, use of, in lenticular cataract, 505
  - in treatment of glaucoma, 563
- Myxœdema, relation of, to diseases of the eye, 586
- Myxoma of conjunctiva, 291
  - of larynx, 901
  - of orbit, 204
  - of throat, pathology of, 720

- NARES, posterior, plugging of, 749
- Nasal burrs, 757
  - diphtheria, 829
    - definition of, 829
    - diagnosis and differential diagnosis of, 830
    - etiology of, 829
    - pathology of, 830
    - symptoms of, 830
    - treatment of, 834
  - chondroma, 892
  - douche cup, 742
  - enostosis, 891
  - exostosis, 891
  - hydrorrhœa, 1041
    - prognosis of, 1042
    - symptoms of, 1042
    - treatment of, 1042
  - hypertrophies, 762
    - treatment of, 765
- insufficiency, hysterical, 1041
  - lipoma, 892
  - odontoma, 892
  - polyps, 763
    - treatment of, 765
  - polypus with ethmoiditis, 881, 882
  - trephines, 757
  - tuberculosis, 851
    - pathology of, 852
    - symptoms of, 852
    - treatment of, 852
- Nasopharyngeal cysts, 722
- Nasopharyngitis, acute, 1020
    - etiology of, 1020
    - symptoms of, 1020
    - treatment of, 1020
  - atrophic, 1022
  - chronic, 1021
    - diagnosis of, 1022
    - etiology of, 1021
    - symptoms of, 1021–22
    - treatment of, 1022
  - and laryngitis, 716
- Nasopharynx, anatomy of, 1005
  - diseases of, 985, 1020
  - tumors of, 1032
    - benign, 1032
    - fibromata, 1032
    - fibromucous polypi, 1035
    - malignant, 1035
- Near point fusion, 152
    - in hyperopia, 93
    - in myopia, 82
- Nearsightedness, 76
- Necrotic diphtheria, 698
    - pathology of, 698

Needle, broad paracentesis, 506
  straight cataract, 507
Neoplasms of larynx, 897
    diagnosis of, 899
      differential, 899
    etiology of, 898
    pathology of, 898
    prognosis of, 900
    pathology of, 898
    symptoms of, 899
    treatment of, 900
  of nose, 877
    malignant, 892
Nerve, fourth, paralysis of, 180, 183
  sixth, paralysis of, 179, 183
  superior laryngeal, paralysis of, 1054
  third, paralysis of, 180, 182
Nerves of the choroid, 343
  ciliary, 343
  effect of diseases of, upon the eye, 651
Neuralgia of larynx, 1047
  trigeminal, relation of, to diseases of the eye, 652
Neuralgias of nose, 1041
Neurasthenia, reversal of field in, 575
Neurectomy, opticociliary, operation of, 413
      dangers and advantages of, 415
Neuritis, multiple, relation of, to diseases of the eye, 651
  optic, 450
    spurious, 454
  retrobulbar, 456
Neuroglia of the optic nerve, method of staining, 679
Neuroparalytic keratitis, 308
Neuroses, auditory, 1102
  of larynx, 1046
    motor, 1047
    sensory, 1046
  of nose, 1036
  of pharynx, 1043
  of throat, 1036
Nichols' spokeshave knife, 756
Night blindness, 580
Nodal point, 59
Nodules, vocal, 715
  hypotheses, 715
Nose, adenocarcinoma of, pathology of, 718
  adenoma of, pathology of, 719
  anæsthesia of, 1040
  angioma of, pathology of, 721
  applications in, 744
  atrophy of, 716
  -bleed, 748
    etiology of, 748
    treatment of, 749
  carcinoma of, pathology of, 718
  chondroma of, 892
    pathology of, 721
  cysts of, pathology of, 722
  deformities of, 1055
    artificial support in, 1062
      appliances used, 1063
Nose, deformities of, concave vertical, 1060
      treatment of, 1060
  diphtheria of, 829
  diseases of, histology of, 689
    pathology of, 689
  disturbances of secretion of, 1041
  douches and sprays of, 739
  epithelioma of, pathology of, 718
  examinations of, methods of, 727
  fibroangioma of, pathology of, 722
  fibroma of, pathology of, 720
  foreign bodies in, 750, 874
      diagnosis of, 750, 874
      removal in, 750, 874
      symptoms of, 750
      treatment of, 750
  fracture of, neglected, 1061
    treatment of, 1061
  hemorrhages of, 690
  hyperæsthesia of, 1040
    symptoms of, 1040
    treatment of, 1041
  inflammations of, 690, 706
    pathology of, 706
  leprosy of, 867
    pathology of, 704
  lipoma of, 892
    pathology of, 720
  lupus of, 865
    histological pathology of, 702
  neoplasms of, 877
    malignant, 892
  neuralgias of, 1041
  neuroses of, 1036
  odontoma of, 892
  osteoma of, 891
    pathology of, 721
  papilloma of, histology of, 719
  paræsthesia of, 1041
  polypus of, 877.
  relation of diseases of, to diseases of the eye, 593
  sarcoma of, pathology of, 719
  scurvy of, 690
  spurs of, 756
    diagnosis of, 756
    pathology of, 756
    treatment of, 756
  syphilis of, 846
    pathological anatomy of, 703
    secondary, 847
    tertiary, 849
  tuberculosis of, pathology of, 699,700
  tumors of, 877, 891
    benign, 719
    malignant, 718, 892
    retention, 722
Noyes-Gould apparatus in treatment of exophoria, 165
Nuclear cataract, 493
Nutrition, disturbances of, 718, 723
Nyctalopia, 580
Nystagmus, 188
  acquired, 189
  congenital, 188

OCULAR ballottement, 481
conjunctiva, 258
muscles, insufficiency of, 158
signs and symptoms attending diseases of the brain, 465
tension, increased, effects of, on the structures of the eye and their respective functions, 528
normal, mechanism for the maintenance of, 524
Odontoma, nasal, 892
O'Dwyer's intubation tubes, 838
Œdema, cardiac, 690
of eyelids, 240
renal, 690
Olfactory cleft, pus in, 982
diagnosis of, 982
differential, 982
Opacities in media, diagnosis of, 43
parallactic displacement of, 43
Operating-mask for practising on animals' eyes, 663
Operation of depression in treatment of cataract, 506
Farlow's, for forward prolongation of septum, 762
the pin, 761
technique of, 761
of solution in treatment of cataract, 507
Operations on the eye, after-treatment of, 664
anaesthesia in, general, 659
local, 660
infiltration, 661
illumination of, 663
position of operator in, 662
of patient in, 661
preparation of dressings for, 658
of instruments, 655
of patient, 653
of region of operation, 654
of sponges, 657
of surgeon and assistants, 655
of sutures and ligatures, 657
time of performance of, 664
on tonsils, 999
Ophthalmia, 259
catarrhal, 260
chronic, 284
Egyptian, 262, 285
military, 262
neonatorum, 273
cause of, 273
complications of, 274
diagnosis of, 274
method of infection, 274
pathology of, 275
prophylaxis of, 274
nodosa, 286
sympathetic, 390
etiology of, 390
pathology of, 393
prophylaxis of, 394
symptoms of, 392
Ophthalmodynamometer, 157
Ophthalmomalacia, 379
Ophthalmometer, Javal and Schiötz's, 114, 115
Ophthalmoplegia, external, 180
internal, 33, 180
progressive, relation of, to diseases of the eye, 645
total, 180
Ophthalmoplegic migraine, 180
Ophthalmoscope, 37
description of, 38
stationary, 40
Ophthalmoscopic examination, indirect, 45
Ophthalmoscopy, application of, to determination of refraction, 116
Opium-poisoning, acute, relation of, to diseases of the eye, 606
Optic disk, 48
cupping of, as a result of glaucoma, 538
ophthalmoscopic appearance of, in absolute glaucoma, 537
foramen, 192
nerve anatomy, 440
atrophy of, 460, 462
changes in, in primary glaucoma, 537
coloboma of sheath of, 450
congenital peculiarities of, 450
development of, 334
fibres, opaque, 420
glaucomatous excavation of, 539
head of, 49
injuries to, 465
radiations, 441
section of, 449
in absolute glaucoma, 537
sheaths of, 441
retained, 420
tumors of, 204, 464
symptoms of, 204
treatment of, 205
neuritis, 450
spurious, 454
papilla, 48
stalk, 334
tracts, development of, 334
vesicles, primary, 476
Optical systems, compound, 63
Opticociliary neurectomy, operation of, 413
dangers and advantages of, 415
Optics, definition of, 53
physiological, 53
Ora serrata, 334
Orbicularis muscle, 232
pupillary reaction, 35
Orbit, anatomy of, 192
cellulitis of, 194
etiology of, 194
symptoms of, 194
treatment of, 195
evisceration of, 207

- Orbit, exenteration of, 207
  - foreign bodies in, treatment of, 199
  - injuries of, treatment of, 199
  - osteitis of, 195
    - etiology of, 195
    - symptoms of, 196
    - treatment of, 197
  - periostitis of, 195
    - etiology of, 195
    - symptoms of, 196
    - treatment of, 197
  - sarcoma of, 202, 203
  - tumors of, 202
    - exploratory incision to determine nature of, 203
    - Krönlein's osteoplastic resection in diagnosis of, 204
    - symptoms of, 202
  - vertical section through the, 149
- Orbital muscles, attachment of, 146
  - tissues, development of, 336
  - tumors, aneurism by anastomosis, 204
    - angioma, 204
    - chondroma, 204
    - cysts, 208
    - encephalocele, 206
    - enchondroma, 204
    - lipoma, 204
    - lymphadenoma, 204
    - lymphangioma, 204
    - lymphoma, 204
    - myxoma, 204
    - osteoma, 205
    - sarcoma, 206
    - tumor of the optic nerve, 204
    - varicose veins, 204
- Oropharynx, diseases of, 985
  - tumors of, 1017
- Orthoform in treatment of tuberculosis of larynx, 860
- Orthophoria, 158
  - determination of, by convex spherical test, 163
  - Maddox's rod-test for, 162
- Osseous growth of conjunctiva, 259, 291
- Ossiculectomy, 1144
  - post-operative care of, 1144
- Ossification of the choroid, 380
- Osteitis of orbit, 195
- Osteoma of nose, pathology of, 721
  - intranasal, 891
  - of orbit, 205
    - treatment of, 206
- Othæmatoma, 1085
  - etiology of, 1085
  - symptoms of, 1086
  - treatment of, 1086
- Otic cerebellar abscess, 1173
    - differential diagnosis of, 1174
    - symptoms of, 1173
    - treatment of, 1174
  - cerebral abscess, 1169
    - diagnosis of, 1171
    - etiology of, 1169
- Otic cerebral abscess, prognosis of, 1171
    - symptoms of, 1169
    - treatment of, 1171
- Otitis media purulenta. (*See* Inflammation of the Middle Ear, Purulent.)
  - acuta, 1127
    - diagnosis of, 1129
    - paracentesis in, 1131
    - prognosis of, 1129
    - symptoms of, 1127
    - treatment of, 1129
  - chronica, 1133
    - diagnosis of, 1134
    - prognosis of, 1134
    - removal of larger ossicles, operation for, 1140
      - after-treatment of, 1144
    - symptoms of, 1133
    - treatment of, 1135
- Otomycosis, 1091
  - fungi causing, 1091
    - diagnosis of, 1091
    - treatment of, 1092
- Oxaluria, relation of, to diseases of the eye, 601
- "Oyster shuckers' keratitis," 300, 304

- PACHYDERMIA of vocal cords, 713
- Pachymeningitis externa with extradural or epidural abscess, 1160
    - prognosis of, 1161
    - symptoms of, 1161
    - treatment of, 1161
  - in middle-ear inflammation, 1119
  - relation of, to diseases of the eye, 639
- Pagenstecher's operation for correction of ptosis, 236
- Palate, cleft, 1065
    - etiology of, 1065
    - symptoms of, 1066
    - treatment of, 1066
      - operative, 1069
  - soft, 989
    - adenoma of, 989
    - angioma of, 989
    - benign growths of, 989
    - carcinoma of, 989
    - malformations of, 985
      - congenital, 985
    - malignant growths of, 989
    - papilloma of, 989
    - sarcoma of, 990
    - wounds of, 1008
- Palpebral conjunctiva, 258
  - fissure, 193
- Panas' operation for correction of ptosis, 236
  - probe for exploring the frontonasal duct, 963
- Panas-Snellen operation for trichiasis, 253
- Pannus, 309
  - carnosus, 309
  - crassus, 309

Pannus, pathology of, 309
  siccus, 309
  tenuis, 309
  treatment of, 310
  vascularis, 309
Panorama asthenopia, 109
Panzer's scissors, 955
Papillitis, 451
Papilloma of caruncle, 292
  of conjunctiva, 291
  intranasal, 887
  of larynx, 897
  of nose, histology of, 719
  removal of, 915
  of throat, histology of, 719
  of uvula, 989
Paraboloidal lenses, 60
Paracentesis of anterior chamber in treatment of glaucoma, 563
Paracusis of internal ear, 1104
Paradoxical pupillary reaction, 35
Paræsthesia of larynx, 1047
  of nose, 1041
  of pharynx, 1044
    prognosis, 1044
    symptoms of, 1044
Parakinesis, 158
Parallax test, 163
Paralysis of abductors of cords, 1054
  agitans, relation of, to diseases of the eye, 642
  bilateral adductor, 1053
  of central abductors, 1054
  conjugate, 181
  of convergence, 181
  of external rectus, 179
  of fourth nerve, 180, 183
  functional, of internal ear, 1104
  of inferior oblique, 181
    rectus, 181
  of the insane, relation of, to diseases of the eye, 640
  of internal rectus, 181
  of levator alæ, 1041
  of ocular muscles, 176
  of pharynx, 1045
  recurrent laryngeal, 1053
  of sixth nerve, 179, 183
  of superior laryngeal nerve, 1054
    oblique, 180
    rectus, 180
  of third nerve, 180, 182
  of thyro-arytenoidei muscles, 1054
  unilateral abductor, 1053
    of orbital muscles, 179
Paralytic mydriasis, 33
  myosis, 31, 32
Parenchymatous keratitis, 311
  inflammations, 706
Parinaud's conjunctivitis, 267
Parosmia, 1039
  etiology of, 1039
  treatment of, 1040
Parry's disease, 208
Pars ciliaris retinæ, 334, 338
  iridica retinæ, 334, 335
Pars optica retinæ, 334, 335
Pellagra, relation of, to diseases of the eye, 63
Pemphigus, 268
  cause of, 268
  relation of, to diseases of the eye, 630
  treatment of, 268
Perichondrial inflammations, 706
Perichondritis of septum, 696
  hyperplastic, 709
Perichoroidal space, 344, 345
Perimeter, measurement of monocular field of fixation by means of, 155
    of squint with, 173
Periosteal inflammations, 706
Periostitis, acute mastoid, 1146
      causes of, 1146
      pathology of, 1147
      treatment of, 1147
  of orbit, 195
  of septum, 709
Periscopic lenses, 61
Peritonsillar abscess, 993
    etiology of, 993
    symptoms of, 993
    treatment of, 994
Perrin's artificial eyes, 37
Petit, canal of, 476
Petrosal sinuses, infective thrombosis of, 1169
Pharyngeal abscess, 697
  arteries, 1008
    anomalies in distribution of, 1008
  tonsil, 1022
Pharyngitis, acute, 1008
    etiology of, 1008, 1009
    phlegmonous, 1013
      symptoms of, 1013
      treatment of, 1013
    symptoms of, 1009
    treatment of, 1009
  atrophic, 1012
    symptoms of, 1012
    treatment of, 1012
  chronic, 1010
    granular, 1010
      etiology of, 1010
      symptoms of, 1011
      treatment of, 1011
    simple, 1010
      etiology of, 1010
      symptoms of, 1010
      treatment of, 1010
  gangrenous, 1013
  granular, 1010
Pharyngocele, 1008
  symptoms of, 1008
Pharyngoscopy, 735
  technique of examination in, 735
Pharynx, anæsthesia of, 1043
    etiology of, 1043
    symptoms of, 1043
    treatment of, 1043

Pharynx, deformities and malformations of, 1007
  diphtheria of, 831
    diagnosis of, 832
      differential, 833
    pathology of, 831
    treatment of, 834
  diseases of, 1008
  foreign bodies in, 1016
    symptoms of, 1016
    treatment of, 1016
  hemorrhage from, 1015
  herpes of, 1013
    symptoms of, 1013
    treatment of, 1014
  hyperæsthesia of, 1043
    diagnosis of, 1044
    etiology of, 1043
    symptoms of, 1044
    treatment of, 1044
  lupus of, 866
    symptoms of, 866
  malformations of, 1007
  motor disturbances of, 1045
  neuroses of, 1043
  paræsthesia of, 1044
    prognosis of, 1044
    symptoms of, 1044
  paralysis of, 1045
  parasitic diseases of, 1014
      mycosis, 1015
      thrush, 1014
  relation of diseases of, to diseases of the eye, 593
  spasm of, 1045
  stenosis of, 1008
  tertiary syphilis of, 850
    diagnosis of, 850
      differential, 850
    pathology of, 850
    symptoms of, 850
    treatment of, 850
  tuberculosis of, 852
    diagnosis of, 852
      differential, 853
    pathology of, 852
    prognosis of, 852
    symptoms of, 852
  wounds of, 1008
Phillips' photophore, 730
Phlegmonous pharyngitis, acute, 1013
    symptoms of, 1013
    treatment of, 1013
Phlyctena pallida, 261
Phlyctenular conjunctivitis, 279
  keratitis, 297
Phosphaturia, relation of, to diseases of the eye, 601
Phosphorus-poisoning, relation of, to diseases of the eye, 605
Phthiriasis ciliorum, 242
  relation of, to diseases of the eye, 630
Phthisis bulbi, 354, 379
    essential, 379
Pigment, choroidal, function of, 66
  retinal, function of, 66
Pilocarpine-poisoning, relation of, to diseases of the eye, 608
Pin operation, 761
Pinguecula, 288
Pink-eye, 268
Placido's disk, 25
    application of, in determining corneal curvature, 114
Plane mirror, use of, in skiascopy, 121
Plano-concave lenses, 61
  -convex lenses, 61
Plexus annularis, 296
Plica semilunaris, 258
Pneumococcic conjunctivitis, 269
Pneumonia, relation of, to diseases of the eye, 595
Policoria, 348
Politzer's bag, 1180
  speculum, 1077
Polypi of conjunctiva, 291
  cysts in, 722
  fibromucous, of nasopharynx, 1035
Polypoid cysts, 880
    symptoms of, 880
    treatment of, 884
Polyps of cords, 714
Polypus, bleeding, of septum, 888
  intranasal, 884
  nasal, with sinusitis, 882
    diagnosis of, 883
    prognosis of, 883
    treatment of, 884
  of nose (œdematous), 877
    etiology of, 877, 880
    microscopic appearance of, 880
    pathology of, 877
  retronasal, 884
  pathology and clinical histology of, 714
Pomeroy head-band and mirror, 729
"Pop-eye," 89
Porencephalus, relation of, to diseases of the eye, 645
Posterior chamber, 340
    exudation into, in cyclitis, 352
      in iritis, 350
  synechiæ, 350
Postnasal growths, 1023
    diagnosis of, 1027
    etiology of, 1023
    prognosis of, 1028
    symptoms of, 1023
    treatment of, 1028
Prag's astigmatic letters, 125
Presbyopia, 69
"Pressure points," 234
Prince's advancement forceps, 187
Principal focus, 57
  point, 59
Prism, determination of the axis of, 140
  displacement produced by, 140
Prisms, action of, upon retinal images, 153

- Prisms in treatment of divergent strabismus, 175
  - of esophoria, 168
  - of exophoria, 165
  - of hyperphoria, 170
- Prismatic fibres of crystalline lens, 475
- Pseudoglioma of the vitreous, 387
- Psoriasis, relation of, to diseases of the eye, 631
- Pterygium, 288
  - diagnosis of, 289
  - recurrences of, 290
  - treatment of, 289
- Ptomaine-poisoning, relation of, to diseases of the eye, 608
- Ptosis, 180, 234
  - acquired, 235
  - adiposa, 235
  - atonica, 235
  - cerebral, 182
  - paralytic, 235
  - treatment of, 235
    - Wolff's operation, 236
  - unilateral, 182
- Puncta lacrymalia, 214
  - atresia of, 219
- Punctum proximum of convergence, 157
  - remotum of convergence, 157
- Pupil, accommodation and convergence reflex of, 31
  - Argyll-Robertson, 32
  - associated reaction of, 31
  - cerebral cortex reflex of, 34
  - color of, 29
  - consensual reflex of, 30
  - direct light reflex of, 30
  - exclusion of, 350
  - indirect reflex of, 30
  - occlusion of, 350
    - following extraction of cataract, 521
  - operations for enlargement of, 365
    - for occlusion of, 369
  - shape of, 29
  - variations in size of, 29
- Pupils, separation of, from each other, 29
- Pupillary membrane, persisting, 333, 346
  - reaction, orbicular, 35
    - paradoxical, 35
- Purpura, relation of, to diseases of the eye, 631
- Purulent leptomeningitis, 1162
  - diagnosis of, 1163
  - etiology of, 1162
  - prognosis and treatment of, 1163
  - symptoms of, 1162
  - otitis media, acute, 1127
    - diagnosis of, 1129
    - paracentesis in, 1131
    - prognosis of, 1129
    - symptoms of, 1127
    - treatment of, 1129
    - chronic, 1133
      - diagnosis of, 1134
      - prognosis of, 1134–45
- Purulent otitis media, chronic, removal of large ossicles, operation for, 1140
  - after-treatment of, 1144
  - symptoms of, 1133
  - treatment of, 1135–46
- Pustule, malignant, relation of, to diseases of the eye, 611
- Pyæmia, relation of, to diseases of the eye, 611
- Pyæmic retinitis, 430

QUININE amblyopia, 461

- RACEMOSE staphyloma, 317
- Radial fibres of Müller, 334
- Real focus, 57
- Red blindness, 570
  - glass test in heterophoria, 160
- Red-green blindness, 570
- Reflex amblyopia, 579
  - consensual, of pupil, 30
  - corneal, examination of the, 24
  - direct light, of pupil, 30
  - fundus, 42
  - Haab's, 34
  - indirect, of pupil, 30,
  - iridoplegia, 32
    - unilateral, 32
  - of pupil, accommodation and convergence, 31
  - streak, 50
- Refraction, 56
  - absolute, in astigmatism, 100
  - cardinal points, 59
  - collective, 58
    - formation of images by, 59
  - at curved surfaces, 56
  - dispersive, 58
  - determination of, application of ophthalmoscopy to, 116
    - conditions governing, 119
    - by direct illumination, 117
    - by the direct method, 118
    - by the indirect method, 117
  - errors of, as a factor in the causation of glaucoma, 540
  - general rules for examining, with the trial case, 126
  - lens, 60
    - cardinal points in, 62
  - subjective tests for, 124
    - astigmatic clock-face, 125
    - direct determination of the far point in myopia, 124
    - test-cards, 126
    - trial case, 126
- Refractive condition, estimation of, by means of test-letters, 73
  - errors, hygienic treatment of, 141
    - objective tests for, 111
    - subjective tests for, 111
    - symptoms of, 108

Refractive errors, symptoms of, in astigmatism, 110
    in hyperopia, 110
    in myopia, 109
  use of cycloplegics in determining, 112
  index, relative, 56
Regressive disturbances of nutrition, 723
Reik's formalin sterilizer, 657
Relapsing fever, relation of, to diseases of the eye, 617
Respiratory tract, effects of diseases of, upon the eye, 593
Retina, anatomy of, 417
  atrophy of, 422, 433
  changes in the, in primary glaucoma, 533
  congenital pigmentation of, 439
  cysticercus of, 438
  detachment of, 435
    glaucoma following, 551
  development of, 333, 334
  distribution of vessels of, 50
  effect of light upon, 433
  embolism of central artery of, 431
  glioma of, 438, 439
  hexagonal pigment cells of, 341
  injuries of, 438
  scheme of structure of, 418
  thrombosis of central artery of, 433
Retinal asthenopia, 109
  image, mental projection and rectification of, 66
  pigment, function of the, 66
  veins, glaucoma following thrombosis of, 552
Retinitis, albuminuric, 423, 425
  circinata, 431
  degenerative, 424
  diabetic, 426
  hemorrhagic, 427, 428, 429
  inflammatory, 424
  leukæmic, 427
  pigmentosa, 434
  proliferans, 430
  pyæmic, 430
  striata, 430
  syphilitic, 421
  thrombotic, 427, 428, 429
Retrobulbar neuritis, 456
Retronasal polypus, 884
Retropharyngeal abscess, 1017
    diagnosis of, 1018
    etiology of, 1017
    symptoms of, 1018
    treatment of, 1018
Rhachitic teeth, 313
Rhachitis, relation of, to diseases of the eye, 585
Rheumatic laryngitis, 812
    etiology of, 812
    symptoms of, 812–816
    treatment of, 816–818
Rheumatism, relation of, to diseases of eye, 612
Rhinitis, acute, 768
Rhinitis, acute, diagnosis of, 771
    etiology of, 768
    prognosis of, 771
    symptoms of, 770
    treatment of, 771
  atrophic, 716, 789
    diagnosis of, 795
    etiology of, 790
    prognosis of, 795
    symptoms of, 792
  chronic, 774
    diagnosis of, 782
    etiology of, 775
    prognosis of, 782
    symptoms of, 777
    treatment of, 782
  dry anterior, 718
  fibrinous, 786
    diagnosis of, 788
    etiology of, 787
    prognosis of, 788
    symptoms of, 788
    treatment of, 788
  hypertrophic, 774
    diagnosis of, 782
    etiology of, 775
    prognosis of, 782
    symptoms of, 777
    treatment of, 782
  sicca anterior, 718
  simple and chronic, 774
    diagnosis of, 782
    etiology of, 775
    prognosis of, 782
    symptoms of, 777
    treatment of, 782
  vasomotor, 691
    pathology of, 691
Rhinoliths, 875
  diagnosis of, 875
  pathology of, 875
  symptoms of, 875
  treatment of, 875
Rhinorrhœa, 804
  cerebro-spinal, 1042
    diagnosis of, 1042
    etiology of, 1042
    symptoms of, 1042
    treatment of, nil, 1043
  diagnosis of, 805
    differential, 805
  etiology of, 804
  prognosis of, 805
  symptoms of, 805
  treatment of, 806
Rhinoscleroma, 705
  histology of, 705
Rhinoscopy, anterior, 727
    attitudes in, 730
    instruments used in, 731
    reflectors for, 728, 729
    source of light in, 727
    technique in, 732, 733
  posterior, 733
    examination in, 733
    requisites for, 733

Richet's operation for ectropion, 255, 256
Ring, choroidal, 48
  scleral, 48
  of Waldeyer, 1005
Ring's eye mask, 658
"Ripe" cataract, 489
Risley's rotary prism, 161
Rupture of choroid, 384

SANTONIN-POISONING, relation of, to diseases of the eye, 607
StClair Thomson's forceps, 978
Sajous' nasal snare, 764
Sarcoma of choroid, 380
  of conjunctiva, 292
  of external ear, 1083
  intranasal, 893
    diagnosis of, 895
    etiology of, 894
    microscopic appearance of, 895
    pathology of, 894
    prognosis of, 895
    symptoms of, 895
    treatment of, 896
  of larynx, 908
    diagnosis of, 909
    etiology of, 908
    pathology of, 909
    sites of, 908
    symptoms of, 909
    treatment of, 909
  of nasopharynx, 1035
  of nose, pathology of, 719
  of orbit, 202, 203, 206
    treatment of, 207
  of soft palate, 990
    symptoms of, 990
    treatment of, 990
  of throat, pathology of, 719
  of tonsils, 1003
    diagnosis of, 1004
    etiology of, 1004
    symptoms of, 1004
    treatment of, 1005
  of uvula, 990
    symptoms of, 990
    treatment of, 990
Scarlatina, relation of, to diseases of the eye, 613
Schleich's infiltration anæsthesia in operations on the eye, 661
Schlemm's canal, 325, 339, 343, 344, 345
"School myopia," 88
Sclera, 324
  anatomy of, 324
  development of, 335
  foreign bodies in, 330
  injuries to, 329
  lacerating wounds of, 329
  rupture of, 330
  staphyloma of, 328
  syphilis of, 328
    treatment of, 329
Scleral ectasiæ, 328
  causes of, 328
Scleral ectasis, treatment of, 328
  ring, 48
Scleritis, 325
  deep, 326
  scrofulous, 327
Sclero-choroiditis posterior, 87
Sclero-kerato-iritis, 327
  symptoms of, 327
  treatment of, 327
Sclerosis, diffuse cerebral, relation of, to diseases of the eye, 642
  disseminated, relation of, to diseases of the eye, 642
Sclerotic, changes in the, in primary glaucoma, 528
Sclerotomy, anterior, in treatment of glaucoma, 561
  posterior, in treatment of glaucoma, 562
Scopolamine, use of, as a mydriatic, 112
Scopolamine-poisoning, relation of, to diseases of the eye, 607
Scotoma, 449
  central, in toxic amblyopia, 448
  negative, 450
  positive, 450
  scintillating, 579
Scotomata, in disseminated choroiditis, 448
Scurvy of nose, 690
  of throat, 690
Seborrhœa, relation of, to diseases of the eye, 630
"Second sight," 492
Seiler's tubular forceps, 917
Senile cataract, 488, 489, 490, 491
Septicæmia, relation of, to diseases of the eye, 611
Septum, bleeding polypus of, 888
    diagnosis of, 890
    etiology, of 889
    pathology of, 889
    prognosis of, 890
    symptoms of, 890
    treatment of, 890
  deviation of, 756
  perichondritis of, 696
    hyperplastic, 709
  periostitis of, 709
  prolongation of, forward, 762
    symptoms of, 762
    treatment of, 763
      Farlow's operation, 762
  straightening of, 759
Sexton's foreign body forceps, 1094
Sexual organs, effects of diseases of, upon the eye, 601
Shadow test, 120
Shurley's powder blower, 912
Siderosis, 403
Siegle's pneumatic speculum, 1177
Sigmoid sinus, infective thrombosis of, 1163
  diagnosis of, 1165
  prognosis of, 1166

Sigmoid sinus, symptoms of, 1163
treatment of, operative, 1166
Silver salts, poisoning by, relation of, to diseases of the eye, 605
Singers' nodes, 827
diagnosis of, 828
etiology of, 828
and pachydermia, removal of, 915, 919
symptoms of, 828
treatment of, 828
Sinuses, accessory, 980
diseases of, 922
differential diagnosis of, 982
mucous lining of, 929
physiology of, 929
suppuration in, acute, 933
etiology of, 933
symptoms of, 934
treatment of, 934
surgical anatomy of, 923
tumors of, 980
ethmoid, 981
frontal, 981
maxillary, 981
sphenoid, 981
cavernous, infective thrombosis of, 1168
ethmoidal, affections of, treatment of, 213
frontal, 926
chronic suppuration in, 956
complications of, 960
diagnosis of, 956
amputation of middle turbinated, 958
by exclusion, 959
nasal examination, 957
sounding the frontal sinus, 958
transillumination test, 956
objections to, 957
treatment of, 960
external operation, 961
intranasal, 960
catheterizing and washing out frontal sinus, 960
puncture of floor of sinus, 960
development of, 927
maxillary, 981
tumors of, 981
petrosal, infective thrombosis of, 1169
sigmoid, infective thrombosis of, 1163
sphenoidal, 928
affections of, treatment of, 213
anatomy of, 928
chronic suppuration in, 973
etiology of, 973
Sinuses, sphenoidal, chronic suppuration in, symptoms of, 973
diagnosis of, 973
development of, 928
suppuration of, 930
bacteriology of, 932
etiology of, 930
morbid anatomy of, 933
Sinusitis, catarrhal, chronic, 979. (*See* Mucocele.)
serous, 979. (*See* Mucocele.)
with nasal polypus, 882
Skiascopy, 120
application of, with the concave mirror, 120
with the plane mirror, 121
central and peripheral shadows, 123
character of the reflex, 122
as a confirmatory test, 124
determination of astigmatism by, 122
of irregular astigmatism by, 123
distance at which test is made, 122
point of reversal, 120
testing the result, 122
use of cycloplegics, 124
Skin, diseases of the, effects of, upon the eye, 629
Skull, deformities of, relation of, to diseases of the eye, 644
Smell, exaggeration of, 1038. (*See* Hyperosmia.)
loss of, 1038. (*See* Anosmia.)
perversion of, 1039. (*See* Parosmia.)
sense of, 1037
disturbance of, 1038
Sneezing, excessive, 1043
Snellen's transparent test-letters, use of, in detection of simulated amblyopia, 577
Snow blindness, 581
Spasm, laryngeal, in adults, 1049
diagnosis of, 1049
etiology of, 1049
symptoms of, 1049
treatment of, 1049
in childhood, 1047
diagnosis of, 1048
etiology of, 1047
symptoms of, 1047
treatment of, 1048
phonatory, 1049
of pharynx, 1045
Spasmodic entropion, 249
heterophoria, 184
Spastic heterophoria, 184
mydriasis, 32
myosis, 31, 32
Speculum, eye, 506
Spencer Watson's method in treatment of trichiasis, 248
Sphenoidal sinus, 928
affections of, treatment of, 213
anatomy of, 928
development of, 928
examination of, 974–77

- Sphenoidal sinus, relation of diseases of, to diseases of the eye, 594
- Spherical aberration, 65
  - lenses, 60
- Sphero-cylinder, 104
- Sphincterolysis anterior, 370
- Spinal cord, effects of diseases of, upon the eye, 645
  - of injuries to, upon the eye, 651
- Splenic fever, relation of, to diseases of the eye, 611
- Sprays, 740
  - formulæ of, 740
  - methods of cleansing nose and throat, 742
- Spring catarrh, 261
- Spurs of nose, 756
  - diagnosis of, 756
  - pathology of, 756
  - treatment of, 756
- Squint, 172
  - constant, 172
  - convergent, 172
  - external, 175
  - measurement of, with perimeter, 173
  - monocular, 172
- Stammering, 1049
  - etiology of, 1049
  - symptoms of, 1049, 1050
  - treatment of, 1050
- Stapes, fixation of, 1195
- Staphylococcus pyogenes aureus, description and pathological significance in diseases of the eye, 684
- Staphyloma, 317
  - consequences of, 318
  - pellucida, 319
  - primary, 317
  - racemose, 317
  - of sclera, 328
  - secondary, 317
  - treatment of, 318
- Staphylotomy, 370
- Stellate punch forceps, 762
- Stellwag's sign in exophthalmic goitre, 209
- Stenosis of larynx, 867
  - etiology of, 867
  - pathology of, 867
  - symptoms of, 868
  - treatment of, 868
  - of pharynx, 1008
- Stereoscope, use of the, in heterotropia, 190
- Sternutation, 1043
- Stevens' phorometer, 160, 161
  - tropometer, 156
- Strabismus, 172
  - alternating convergent, 174
    - diagnosis of, 174
    - symptoms of, 174
    - treatment of, 175
  - divergent, 175
    - etiology of, 175
    - symptoms of, 175
- Strabismus, divergent, treatment of, 175
  - dynamic, 158
  - hooks, 413
  - internal or convergent, diagnosis of, 172
    - symptoms of, 172
    - treatment of, 173
- Streatfeild operation for trichiasis, 253
- Streptococcus pyogenes, description and pathological significance in diseases of the eye, 684
- Stroschein's flask, 661
- Stye, 242
- Styles, 229
- Subdural abscess, 1161
  - symptoms of, 1161
  - treatment of, operative, 1162
- Subhyaloid hemorrhage, 430
- Submucous inflammation, 695
  - pathology of, 695
- Substantia propria, 295
- Sulcus scleræ, 294
- Sulphonal-poisoning, relation of, to diseases of the eye, 606
- Suppuration in accessory cavities, 935
  - frequency of, 935, 936, 937
  - symptoms of, 937
  - in anterior group of sinuses, combined, 972
    - diagnosis of, 972
    - treatment of, 972
      - indications for, 972
  - chronic, in accessory sinuses, 935
    - in sphenoidal sinus, 973
      - diagnosis of, 973
      - etiology of, 973
      - examination of, 974
        - canula for washing out sphenoidal sinus, 974
        - methods of, 974
      - symptoms of, 973
      - treatment of, 977
  - of sinuses, 930
- Supraduction, measurement of, 154
- Supra-orbital notch, 192
- Suprarenal extract, use of, in diseases of the nose and throat, 745
- Supravaginal space, 345
- Sursumvergence, 152
- Sweet's apparatus for localizing foreign bodies in the eye, 406
- Symblepharon, 255, 293
  - treatment of, 293
- Sympathetic ophthalmia, 390
- Synchisis corporis vitrei, 387
  - scintillans, 387
- Synechiæ, anterior, of hyaloid membrane of the vitreous, glaucoma following, 548
  - of iris, glaucoma following, 547
  - of lens capsule, glaucoma following, 548
  - posterior, 350
    - annular, 350

- Synechiæ, posterior, of iris, glaucoma following, 546
  - total posterior, 352
- Syphilis, congenital, relation of, to diseases of the eye, 626
  - of conjunctiva, 283
  - of eyelids, 241
  - inherited, permanent incisors in 313
  - of larynx, 848
    - secondary, 848
      - diagnosis of, 848
      - pathology of, 88
      - symptoms of, 848
      - treatment of, 848
    - tertiary, 851
      - pathology of, 851
      - treatment of, 851
  - of nose, 846
    - acquired, 847
    - congenital, 846
    - pathological anatomy of, 703
    - secondary, 847
      - diagnosis of, 848
      - pathology of, 847
      - symptoms of, 847
    - tertiary, 849
      - diagnosis of, 849
      - pathology of, 849
      - symptoms of, 849
      - treatment of, 849
  - of pharynx, 850
    - tertiary, 850
      - diagnosis and differential diagnosis of, 850
      - pathology of, 850
      - symptoms of, 850
      - treatment of, 850
  - relation of, to diseases of the eye, 621
  - of sclera, 328
  - of throat, 846
    - acquired, 847
    - congenital, 846
    - pathological anatomy of, 703
    - secondary, 847
    - tertiary, 849
      - diagnosis of, 849
      - pathology of, 849
      - symptoms of, 849
      - treatment of, 849
- Syphilitic chorioretinitis, 374
  - iritis, 355
  - retinitis, 421
- Syringomyelia, relation of, to diseases of the eye, 645

- TABES dorsalis, relation of, to diseases of the eye, 645
- Tænia mediocanellata in the vitreous, 388
- Tarsal asthenopia, 109
  - conjunctiva, 258
- Tarsi, 231
- Tarsitis syphilitica, 241
- Tarsorrhaphy, 232
- Tenonitis, 197
- Tenon's capsule, 149
- Tenon's space, 344, 345
- Tenotomy, partial, in treatment of esophoria, 168
  - in treatment of exophoria, 166
    - of hyperphoria, 171
- Tension, normal ocular, mechanism for the maintenance of, 524
  - ocular, effect of increased, on the structures of the eye and their respective functions, 528
    - method of indicating, degrees of, 36
- Tertiary syphilis of nose, 849
  - diagnosis of, 849
  - pathology of, 849
  - symptoms of, 849
  - treatment of, 849
- Test, red glass, 160
  - touch, 177
- Test-cards, use of, in determining refraction, 126
- Test-letters, estimation of accommodative power by means of, 73
    - of refractive condition by means of, 73
  - method of measuring visual acuity with, 72
- Theobald's probes, 219
- Thomas' atomizing vaporizer, 911
- Thomson's modification of Holmgren's wool-test for detection of color blindness, 572
- Throat, adenocarcinoma of, pathology of, 718
  - adenoma of, pathology of, 720
  - angioma of, pathology of, 721
  - applications in, 744
  - atrophy of, 716
  - carcinoma of, pathology of, 718
  - chondroma of, pathology of, 721
  - cysts of, pathology of, 722
  - diphtheria of, 829
  - diseases of, histology of, 689
    - pathology of, 689
  - epithelioma of, pathology of, 718
  - examination of, methods of, 727
  - fibroangioma of, pathology of, 722
  - fibroma of, pathology of, 720
  - foreign bodies in, 874
    - diagnosis of, 874
    - removal of, 874
  - hemorrhages of, 690
  - inflammations of, 690
  - leprosy of, 867
    - pathology of, 704
  - lipoma of, pathology of, 720
  - lupus of, 865
    - histological pathology of, 702
  - myxoma of, pathology of, 720
  - papilloma of, histology of, 719
  - sarcoma of, pathology of, 719
  - scurvy of, 690
  - syphilis of, 846
    - pathological anatomy of, 703
    - secondary, 848
    - tertiary, 849

- Throat, tuberculosis of, pathology of, 699, 700
  - tumors of, benign, 719
    - malignant, 718
    - retention, 722
- Thrombosis of cavernous sinus, 201
  - of central artery of retina, 433
  - of cerebral vessels, relation of, to diseases of the eye, 633
  - infective, of cavernous sinus, 1168
      - etiology of, 1168
      - symptoms of, 1168
      - prognosis of, 1168
    - of petrosal sinuses, 1169
    - of sigmoid sinus, 1122, 1163
      - diagnosis of, 1165
      - prognosis of, 1166
      - symptoms of, 1163
      - treatment of, operative, 1166
  - of retinal veins, glaucoma following, 552
- Thrombotic retinitis, 427, 428, 429
- Thrush, 1014
  - symptoms of, 1014
  - treatment of, 1014
- Todd's "tucker," 189
- Tongue depressors, 735
- Tonometers, 36
- Tonsillar abscess, 993
    - etiology of, 993
    - symptoms of, 993
    - treatment of, 994
  - tuberculosis, 700
    - appearances of, 700
    - forms of, 700
- Tonsillitis, acute catarrhal, 990
    - etiology of, 990
    - symptoms of, 990, 991
    - treatment of, 991
  - lacunar, 991
    - etiology of, 991
    - symptoms of, 991
    - treatment of, 992
  - ulcerative, 995
    - symptoms of, 995
    - treatment of, 995
- Tonsilloliths, 1003
  - definition of, 1003
  - symptoms of, 1003
  - treatment of, 1003
- Tonsils, carcinoma of, 1004
    - diagnosis of, 1005
    - pathology of, 1004
    - treatment of, 1005
  - cysts of, 722
  - diseases of, 990
  - foreign bodies in, 1003
  - hypertrophy of, 996
    - etiology of, 996
    - symptoms of, 996
    - treatment of, 997
      - local, 997
      - operative, 999
        - after-treatment, 1002
        - cold wire snare, 1001
- Tonsils, hypertrophy of, treatment of, operative, electric wire snare, 1001
        - enucleation, 1003
        - guillotine, 999
  - lingual, 1005
    - hypertrophy of, 1005
    - location of, 1005
  - operations on, 999
  - sarcomata of, 1003
    - diagnosis of, 1004
    - etiology of, 1003
    - symptoms of, 1004
    - treatment of, 1004
  - tumors of, 1003
    - benign, 1003
      - angioma, 1003
      - echinococcus cysts, 1003
      - fibrochondroma, 1003
      - fibroma, 1003
      - papilloma, 1003
    - malignant, 1003
      - carcinoma, 1004
      - sarcoma, 1003
  - wounds of, 1008
- Toric lenses, 60
- "Touch test," 177
- Toxalbumin-poisoning, relation of, to diseases of the eye, 608
- Trachea, relation of diseases of, to diseases of the eye, 595
  - thyroid tumor of, 903
- Tracheal injections, 860
- Trachoma, 262
- Traumatism of larynx, 919
- Treatment of adenoid vegetations, 1028
  - of adenoma papillare, 888
  - of albinism, 371
  - of anæsthesia of pharynx, 1043
  - of anosmia, 1039
  - of anosphresia, 1039
  - of asthma, 809
  - of atrophic catarrh of middle ear, 1197
  - of benign tumors of iris, 359
  - of bleeding polypus of septum, 890
  - of blepharitis, 242
  - of blepharospasm, 234
  - of blood-staining of cornea, 322
  - of carcinoma of larynx, 906
    - of nasopharynx, 1035
    - of tonsils, 1005
  - of cataract, 503
    - complicated, 506
    - lenticular, 504
    - traumatic, 483
    - zonular, 504
  - of cellulitis of orbit, 195
  - of cerebellar abscess, otic, 1174
  - of cerebral abscess, otic, 1171
  - of cerebro-spinal rhinorrhœa, 1043
  - of chalazion, 243
  - of chondroma of larynx, 903
  - of chorea of larynx, 1049
  - of choroidal coloboma, 371
  - of choroiditis, acute exudative, 373

- Treatment of choroiditis nodosa, 828
    - suppurative, 378
  - of chronic suppuration of frontal sinus, 960
  - of circumscribed inflammation of auditory meatus, 1089
  - of concave vertical deformity of nose, 1060
  - of congenital anomalies of the eyelids, 238
  - of conjugate paralysis, 182
  - of conjunctivitis, acute contagious, 269
    - chronic, 285
    - diphtheritic, 277
    - follicular, 262
    - gonorrhœal, 272
    - granular, 265
    - lacrymal, 260
    - lithiasis, 261
    - membranous, 278
    - phlyctenular, 281
    - simple, 260
    - subacute, 270
    - toxic, 286
    - vernal, 262
  - of cyclitis, 356
  - of cyclophoria, 171
  - of dacryoadenitis, acute, 216
    - chronic, 216
  - of dacryocystitis, 228
  - of deaf mutism, 1107
  - of diffuse inflammation of auditory meatus, 1091
  - of diphtheria of nose, 834
    - of pharynx, 834
  - of diseases of uvula, 987
  - of eczema of external ear, 1081
  - of elongation of uvula, 988
  - of emphysema of conjunctiva, 287
  - of empyema of anterior ethmoid cells, 968
    - of antrum of Highmore, 948
  - of entozoa in vitreous humor, 389
  - of epiphora, 221
  - of episcleritis, 325
    - persistent, 326
  - of epistaxis, 749
  - of esophoria, 167
  - of ethmoidal suppuration, 972
  - of Eustachian catarrh, chronic, 1185
  - of exophoria, 165
  - of exophthalmic goitre, 209
  - of fibroma of nasopharynx, 1033
  - of fistula of cornea, 306
  - of foreign bodies in cornea, 322
    - in external ear, 1093
    - in nose, 750
    - in orbit, 199
  - of forward prolongation of septum, 762
  - of fractures of nose, 1056
    - neglected, 1061
  - of frontal sinus suppuration, 972
  - of glaucoma, primary, 556
  - of gout of the conjunctiva, 267
- Treatment of hay fever, 802
  - of hemorrhage into vitreous humor, 388
  - of herpes corneæ, 310
    - of pharynx, 1014
  - of hyalitis, 386
  - hygienic, of refractive errors, 141
  - of hyperæsthesia of larynx, 1046
    - of nose, 1041
    - of pharynx, 1044
  - of hyperosmia, 1038
  - of hyperosphresia, 1038
  - of hyperphoria, 170
  - of hypertrophy of tonsils, 997
  - of impacted cerumen, 1088
  - of infective thrombosis of sigmoid sinus, 1166
  - of influenza, 807
  - of injuries of conjunctiva, 287
    - of orbit, 199
  - of intranasal adenoma, 891
    - adhesions, 751
    - fibroma, 887
    - papilloma, 888
    - sarcoma, 896
  - of iritis, 356
    - diabetica, 358
    - gonorrhœica, 358
    - rheumatica, 358
    - syphilitic, 358
  - of keratectasia, 319
  - of keratitis, bullous, 311
    - deep vascular, 316
    - desiccation, 308
    - eczematous, 299
    - filamentous, 306
    - marginal, 302
    - neuroparalytic, 309
    - parenchymatous, 314
    - sclerosing, 315
  - of keratoconus, 320
  - of lagophthalmos, 233
  - of laryngeal vertigo, 1052
  - of laryngitis, acute, 816
      - in childhood, 816
    - chronic, 821
      - dry, 825
      - hypoglottic, 823
    - hæmorrhagica, 816
    - hypoglottica, 816
    - pachydermia, 827
    - rheumatic, 816
    - sicca acuta, 816
  - of leptomeningitis, purulent, 1163
    - serous, 1162
  - of loss of vitreous humor, 388
  - of lupus of larynx, 867
    - of nose, 867
    - of throat, 867
  - of lymphangiectasis, 290
  - of malignant tumors of iris, 360
  - of mastoiditis, 1148
  - of maxillary suppuration, 972
  - of membranous angina, 996
  - of mucocele, 211, 224, 980
    - in infants, 226

Treatment of mycosis, 1015
  of nasal hydrorrhœa, 1042
    hypertrophies, 765
    polyps, 765
      with sinusitis, 884
  of nasopharyngitis, acute, 1020
    chronic, 1022
  of negative pressure of tympanum, 1199
  of neoplasms of larynx, 900
  of nose-bleed, 749
  of opacities in vitreous humor, 386
  operative, of subdural abscess, 1162
  of ophthalmia neonatorum, 275
  of orthæmatoma, 1086
  of osteitis of orbit, 197
  of osteoma of orbit, 206
  of otitis media purulenta acuta, 1129
      chronica, 1135
  of otomycosis, 1092
  of pachymeningitis externa, 1161
  of pannus, 310
  of parosmia, 1040
  of pemphigus, 268
  of periostitis of orbit, 197
  of peritonsillar abscess, 994
  of pharyngitis, acute, 1009
    acute phlegmonous, 1013
    atrophic, 1012
    chronic granular, 1011
      simple, 1010
  of polypoid cysts, 884
  of pseudocroup, 816
  of pterygium, 289
  of ptosis, 235
  of pulsating exophthalmos, 200
  of retropharyngeal abscess, 1018
  of rhinitis, acute, 771
    atrophic, 795
    fibrinous, 789
    hypertrophic, 782
    simplex, 782
  of rhinoliths, 875
  of rhinorrhœa, 806
  of rupture of choroid, 384
  of sarcoma of larynx, 909
    of nasopharynx, 1035
    of orbit, 207
    of soft palate, 990
    of tonsils, 1005
    of uvula, 990
  of scleral ectasiæ, 328
  of sclero-kerato-iritis, 327
  of spasm of larynx in adults, 1049
      in childhood, 1048
  of spurs of nose, 756
  of stammering, 1050
  of staphyloma, 318
  of stenosis of larynx, 868
  of strabismus, alternating convergent, 175
    divergent, 175
    internal convergent, 173
  of striated opacities of cornea, 316
  of suppuration, acute, of accessory sinuses, 934
Treatment of suppuration in anterior group of sinuses, 972
    chronic, in sphenoidal sinus, 977
  of symblepharon, 293
  of sympathetic ophthalmia, 396
  of syphilis of larynx, 851
      secondary, 848
    of nose, tertiary, 849
    of pharynx, 850
    of sclera, 329
    of throat, tertiary, 849
  of thrombosis of cavernous sinus, 202
  of thrush, 1015
  of tonsillar abscess, 994
  of tonsillitis, acute catarrhal, 991
      lacunar, 992
      ulcerative, 995
  of tonsilloliths, 1003
  of trichiasis, 248
  of tuberculosis of nose, 852
    of larynx, 859
  of tumors of accessory sinuses, 981
    of maxillary sinus, 981
    of optic nerves, 205
  of uvulitis, 987
  of wounds of membrana tympani, 1096
Trial case, use of, in determining refraction, 126
Trichiasis, treatment of, 248
Trochlearis palsy, 180
Trophoneuroses, effect of, upon the eye, 649
Tscherning's theory of the mechanism of accommodation, 68
Tubercular disease of the middle ear, 1121
  leptomeningitis in mastoiditis, 1121
  meningitis, relation of, to diseases of the eye, 639
Tuberculosis, adenoid, 701
  of conjunctiva, 282
  of larynx, 701, 853
    pathology of, 702
    clinical appearance of, 702
  of nose, 851
    pathology of, 699, 700
  of pharynx, 852
  relation of, to diseases of the eye, 628
  tonsillar, 700
Tumores cavernosi of eyelids, 244
Tumors of accessory sinuses, 981
      diagnosis of, 981
      treatment of, 981
  benign, of external ear, 1083
    of nose, 719
    of palate, 989
    of throat, 719
    of uvula, 989
  of ethmoid sinus, 981
  of frontal sinus, 981
  of internal ear, 1104
  of larynx, 897
    adenoma, 903
    angioma, 902
    carcinoma, 904
    chondroma, 902

- Tumors of larynx, cysts of, 901
  - fibroma, 901
  - lipoma, 902
  - myxoma, 901
  - papilloma, 897
  - sarcoma, 908
  - thyroid, 903
- malignant, of nose, 718
  - of throat, 718
- of maxillary sinus, 981
  - diagnosis of, 981
  - treatment of, 981
- of nasopharynx, 1032
  - benign, 1032
  - fibromata, 1032
  - fibromucous polypi, 1045
  - malignant, 1035
- of nose, 877
  - malignant, 892
- of oropharynx, 1017
- retention, of mucosa, 722
  - of nose, 722
  - of throat, 722
- of sphenoid sinus, 981
- of tonsil, 1003. (*See* Tonsil, Tumors of.)
- Tunica vasculosa lentis, 332
- Türek's tongue depressor, 735
- Tympanic membrane, massage of, 1181
- Tympanotomy, exploratory, 1192
- Tympanum, negative pressure in, 1198
  - causation of, 1198
  - diagnosis of, 1199
  - pathology of, 1198
  - prognosis of, 1199
  - symptoms of, 1199
  - treatment of, 1199
- variations in atmospheric pressure in, 1198
  - causation of, 1198
  - changes produced by, 1198
  - diagnosis of, 1199
  - negative pressure, 1198
  - pathology of, 1198
  - prognosis of, 1199
  - symptoms and signs of, 1199
  - treatment of, 1199
- Typhoid fever, relation of, to diseases of the eye, 616
- Typhus fever, relation of, to diseases of the eye, 617
  - recurrens, relation of, to diseases of the eye, 617
- Tyrell's blunt hook, 511

- UNILATERAL paralysis of the orbital muscles, 179
  - reflex iridoplegia, 32
- Uræmic amaurosis, 424
  - amblyopia, 577
- Uric-acid diathesis, relation of, to diseases of the eye, 601
- Urinary organs, effects of diseases of, upon the eye, 598
- Urticaria, relation of, to diseases of the eye, 631
- Uvea, anatomy and physiology of, 336
  - nerves of, 343
- Uveal tract, development of, 335
- Uveitis, anterior, 327
- Uvula, 989
  - adenoma of, 989
  - angioma of, 989
  - benign growths of, 989
  - degeneration of muscular fibres in, 724
  - diseases of, 987
    - diagnosis of, 987
    - etiology of, 987
    - symptoms of, 987
    - treatment of, 987
  - elongation of, 987
    - causes of, 987
    - symptoms of, 987
    - treatment of, 988
  - hæmatoma of, 988
  - malformations of, 985
    - congenital, 985
  - malignant growths of, 989
    - carcinoma of, 989
    - papilloma of, 989
    - sarcoma of, 990
- Uvulitis, 987
  - diagnosis of, 987
  - etiology of, 987
  - symptoms of, 987
  - treatment of, 987

- VACCINATION, relation of, to diseases of the eye, 616
- Vaccinia of the eyelid, 240
- Valve, Hasner's, 216
- Van Gieson's method for preparing sections of the eyeball, 676
- Van Milligen operation for trichiasis, 252
- Varicella, relation of, to diseases of the eye, 616
- Varicose veins in the orbit, 204
- Variola, relation of, to diseases of the eye, 614
- Variolous eruptions upon the eyelids, 240
- Vascular engorgement, chronic, of middle ear, with exudation, 1186
  - diagnosis of, 1188
  - etiology of, 1186
  - prognosis of, 1187
  - symptoms of, 1187
- Vasomotor catarrh. (*See* Hay Fever.)
  - rhinitis, 691
    - pathology of, 691
- Veasey's portable sterilizer, 656
- Ventricle, laryngeal, prolapse of, 903
- Ventricular hypertrophy, 713
- Vernal conjunctivitis, 261
- Vertigo, laryngeal, 1051
  - etiology of, 1051
  - prognosis of, 1052
  - symptoms of, 1052
  - treatment of, 1052

Virtual focus, 57
Vision in astigmatism, 101
    binocular, 74
    cells, 334
    disturbances of, without apparent lesion, 568
    physiology of, 53
Visual acuity, 71
        exceeding the standard, 73
        method of measuring, with test-letters, 72
    angle, 71
    field, eccentric contraction of, in gray atrophy of optic nerve, 446
        homonymous quadrant hemianopsia, 447
        normal, 445
    sensation, duration of the, 74
Vitreous humor, bloodvessel formation in, 387
        changes in the, in primary glaucoma, 533
        cholesterin crystals in, 387
        congenital anomalies of, 385
        degenerations of, 387
        detachment of, 387
        development of, 333
        entozoa in, 388
            treatment of, 389
        exudation into, in cyclitis, 352
        fatty degeneration of, 387
        fluidity of, 387
        hemorrhage into, 388
            treatment of, 388
        injuries of, 387
        loss of, 387
            treatment of, 388
        macroscopic anatomy, 384
        microscopic anatomy, 385
        opacities in the, 385
            treatment of, 386
        physiology of, 384
        pseudoglioma of, 387
Vocal cords, carcinoma polypoides of, 905
        pachydermia of, 713
            histological pathology of, 713
    nodules, 715
Von Graefe's cystotome, 511
Von Graefe's linear knife, 364
    sign in exophthalmic goitre, 209

WATSON operation, 761
    Weber's canaliculus knife, 222
Weeks' scarificator, 266
Weigert's method for staining nerve sheaths, 677
Wernicke's sign, 34
Whistler's cutting dilator, 869
White's palate retractor, 734
Whooping-cough, relation of, to diseases of the eye, 620
Wilder's operation for correction of ptosis, 237
Wilkinson's disease, relation of, to diseases of the eye, 642
Wolfe's method of blepharoplasty, 246
Wolff's operation for correction of ptosis, 236
Wright's nasal snare, 764

X-RAYS, use of, in locating foreign bodies in the eye, 405
Xanthelasma, 244
Xanthoma palpebrarum, 592
Xerophthalmia, 285
Xerosis bacillus, 684
    epithelialis, 278
        cause of, 278
        complications of, 279
        description and symptoms of, 278
        diagnosis of, 279
        pathology of, 279
        treatment of, 279
    infantilis, 278
    triangularis, 278

YELLOW fever, relation of, to diseases of the eye, 621
Young-Helmholtz theory of color vision, 570
        of production of color, 54

ZEISS, glands of, 231
    Ziegler's prism-scale, 140
Zinn, zonule of, 340, 476
Zonular cataract, 499, 504
Zonule of Zinn, 340, 476

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